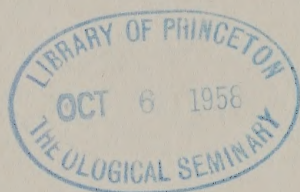


ALEXANDRIA. THE GOLDEN CITY



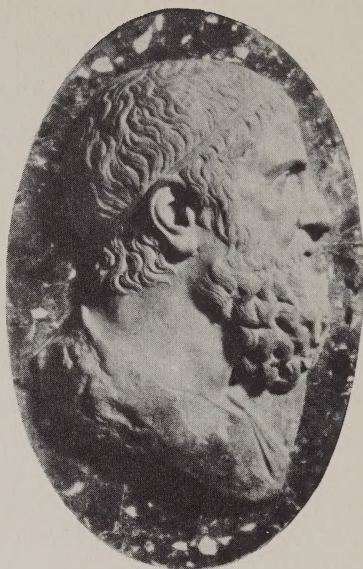
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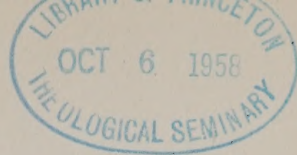
Archimedes



Ptolemy Philadelphus
and Queen Arsinoe



Euclid — Author of the
Elements of Geometry



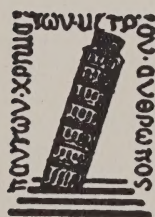
ALEXANDRIA, THE GOLDEN CITY

By

HAROLD T. DAVIS
Northwestern University

In Two Volumes

Volume I -- THE CITY OF THE PTOLEMIES



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DEDICATION OF VOLUME ONE

To My Sister Marjorie,
Whose Appreciation of Classical Languages,
and of Classical Culture Has Kept Alive the
Interest of the Author in These Matters, this
Story of THE CITY OF THE PTOLEMIES is
Affectionately Dedicated.

INTRODUCTORY REMARKS

The story of a city is not unlike the biography of a man. Its life begins when it is founded; it grows into vigorous stature, nurtured by the forces which occasioned the selection of its site; it has moments of great prosperity when the tides of fortune are at their full; it has moments of despair when wars, floods, pestilence, and civil riots sweep over its boundaries; it dies at last when political and economic decay have finally destroyed its ability to meet the changing patterns of life.

This book is dedicated to the story of Alexandria, called by Athenaeus "the golden city." The story of Athens has been told by many writers; the rise and fall of Rome has been the favorite theme of the historians; but the city of Alexandria has never had an extensive biography. This is a curious fact, indeed, since Alexandria, founded in 332 B. C. by Alexander the Great, developed into regal magnificence under the Macedonian Ptolemies, and for nearly a thousand years was one of the most remarkable cities in the world. The infirmities of old age came upon it near the close of the Roman Empire and the weary city finally passed into oblivion about 646 A. D. when the Saracen invaders destroyed at last the monuments of its old-world glory. Thus stretches the biography of Alexandria across ten of the most interesting centuries in human history!

Alexandria in some respects is more important to the modern world than was either Athens or Rome, for in Alexandria we find much more of the scientific spirit than was exhibited in any other portion of the ancient world. Astronomy assumed a modern form; the earth was measured with amazing accuracy and the inquiring minds of the Alexandrians devised methods for determining such important values as the diameter of the sun and the moon, and the size of the orbit of the earth. The heliocentric theory of the solar system had been conceived; the movements of the tides were traced to the action of the moon. Euclid had produced a geometry which was to remain a standard text-book for twenty-two centuries or more. Archimedes had developed

a method for finding the areas under certain curves and the volumes of special solids; Apollonius had exhibited the beautiful properties of the conic sections; Diophantus had founded the algebraic method. It is not unfair to say that the combined genius of the Alexandrians had pushed astronomy and mathematics almost to the point, where, twenty centuries later, Kepler, Galileo, Tycho Brahe, Descartes, Newton and other giants were again to take it up.

In medicine and art, in poetry and literary criticism, in geography and exploration, in history and philosophy, in a word, in all those matters which require a lively imagination and a capacity for arduous labor, the Alexandrians enriched the world.

The golden city was also the cradle of the Christian religion. The battle between pagan philosophy and the new religious ideas of the east was fought for four centuries in Alexandria. Philo, the Pythagorean, St. Mark, the evangelist, Plotinus, the Neoplatonist, Clement, the Greek father of the Church, Origen, founder of dogmatism, Athanasius, the exile, St. Anthony, the hermit, all march across the Alexandrian stage in the colorful drama of those ancient days.

Nestled in among matters then regarded as of greater importance to the city, we find the astonishing inventions of Hero, which might have changed the entire course of history had their significance been fully recognized. Working with the mysteries of the vacuum, he created numerous ingenious devices which involved in a fundamental way the principle of the steam engine. How narrowly, then, did the ancient world miss the advantages of this great power in the world of today!

The neglect of Alexandria, in comparison with Athens and Rome, may possibly be traced to the assumption that Alexandrian literature was inferior to that produced by these other cities. For this reason the period of the Ptolemaic rulers has frequently been called "the Silver Age" of Hellenistic literature. But while the greatest contribution of the Alexandrians was for us their superb science and the colorful human drama which unfolds in the war of the philosophies, the literature of that period was also astonishing enough. At the beginning of its history we find the imposing figure of Callimachus, the Dr. Johnson of his age, unable himself to attain the highest flights of poetry, but a trenchant critic, a writer of dictionaries, the high

priest in the temple of the Muses. Two centuries later, the Roman poet Catullus, when his own Muse was halted by the death of his brother, wrote to a friend:

“And yet, despite these griefs of mine, O Hortalus,
I send to you this song of Callimachus.”

The influence of this ancient poet is seen even in our own day in some of the lines of “the Rape of the Lock” by Alexander Pope.

And were it not for the matchless epics of Homer and Virgil, we would turn today with far more appreciation to the majestic verses of the *Argonautica*, written by the Alexandrian singer, Apollonius of Rhodes. For in the eight or more centuries between Homer and Virgil there is no epic which can be compared with it; nor has its influence been negligible in the literary creations of our own time.

And certainly of the highest genius was Theocritus, creator of pastoral poetry, whose delicate lines have woven a golden thread through the literary strands of poets of later times. And the novel, too, and the tale of romantic adventure, had their origin in the literary efforts of the Alexandrian school. These matters we shall set forth in more detail at the proper time; it suffices now to show that the literary efforts of the Alexandrians are themselves a sufficient excuse for a history of the astonishing city which created them.

And the women of Alexandria! How could the story be complete without an account of them and the dramas in which they played a part:— Olympias, the witch-woman, mother of Alexander the Great; Arsinoë, the charming queen-goddess, who presided over the most spectacular court of ancient times; Berenice, whose stolen tresses are to be remembered forever in the name of the most delicate constellation in the sky; Cleopatra, Queen of Egypt, whose magic enthralled two of the most eminent Romans of their times and brought one of them to ruin.

Nor can we forget Zenobia, the famous Queen of Palmyra, brought finally to Rome to adorn the triumph of Emperor Aurelian; nor Hypatia the beautiful philosopher, whose tragic death at the hands of the Christian mob marked the end of the four-century struggle between pagan philosophy and the religion which was to dominate both prince and pauper for many long years thereafter.

The history of Alexandria has also given us other names: Thais, the brilliant courtesan of Alexander the Great, and later, if we can believe the story, the wife of the first Ptolemy, prototype of the fanciful Thais of the tale of Anatole France; Agathocleia, the dark and crafty enchantress, whose plots finally brought the fourth Ptolemy to his ruin; Cleino, the cupbearer in the court of Ptolemy Philadelphus; Mnesis, the flute-girl; and Myrtion, one of the most notorious actresses of her day. The lives of these women are human dramas, now but dimly seen through the veil that time has wrapped around them.

The golden city is also not without its significance as an interpreter of the dramatic spectacles of our own times when mankind viewed with amazed bewilderment the convulsions of a war-torn world. For one will find in the chronicles of Alexandria every form of human passion. He will see a procession of kings both good and evil. He will become acquainted with emperors of lofty vision and with others whose degradation of mind and action surpasses belief. He will view periods in which human happiness reaches one of its higher points, when the arts and sciences flourish in a golden age. He will witness the rapid change to eras of tumult and civil war when storms of incredible human brutality sweep across the scene. And through these changing patterns of human happiness and human woe he may be able to understand more easily the reasons why the world is so often shaken by evil forces. And he may also derive the hope that these storms like others finally pass away and more benevolent periods emerge at last from the rack and ruin of the past.

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ALEXANDRIA, THE GOLDEN CITY

VOLUME ONE

THE CITY OF THE PTOLEMIES

CHAPTER 1

THE COURT OF PTOLEMY PHILADELPHUS

1. *We Enter the Golden City.*

DURING ONE OF THE winter months of the year 279 B. C. there was great activity in the city of Alexandria. King Ptolemy Philadelphus, who had become ruler of Egypt some six years earlier on the voluntary abdication of his father, Ptolemy Soter (the Deliverer), was about to inaugurate the Five-years' Feast with a gigantic festival. Months had been spent in preparation for this event, which was to honor the memory of his father and his mother, who had recently died. Because of the significance of the occasion and the fact that riches beyond the dreams of Arabian fairy tales had been part of his inheritance, the king had resolved to dazzle the eyes of his subjects with a pageant that should excel any other in the history of man. The details of this festive occasion overwhelm the imagination and certainly strain one's credulity, for such was the magnificence of the display arranged by the wealthy king. But from it one can appreciate better than in any other ways the astonishing character of the city which in later years was to be called by Athenaeus "*the Golden City of Alexandria.*"

In order that we may possess some of the advantages of an eye-witness to this festival, let us assume that a few days before the event we set sail with some scholars of Rhodes to be present at the feast. Our ship approaches the African coast as night falls, but we continue our course by the stars. There behind us wheel the two bears and almost directly over our bow and half way up the arch of the sky blaze Orion and Sirius, with the great Canopus below them just grazing the edge of the ocean. High in the western sky twinkle the Pleiades, while Leo keeps guard over the deserts of the east.¹

Suddenly the pilot calls out: "A light! A light! The star of Pharos!"

¹ The positions of the stars and constellations were checked by recasting the Alexandrian sky for the year in question at the Adler planetarium in Chicago.

And there over our bow we see, indeed, that a new star has risen from the sea. Yellow it is and without a twinkle as the ones above us.

"It comes from the new lighthouse on the island of Pharos," the master informs us. "There is a sight that even you Rhodians for all your Colossus will look upon with wonder. We shall see it by the light of early morning if the wind holds."

And truly he spoke for as the sun rose from the sea in a cloud of fire the first rays touched the top of such a sight as one will never see in all the world again. There is the tower of Pharos, shimmering in white marble, one story piled upon another, and reaching the incredible height of nearly six hundred feet. The structure itself consists of four separate parts, the first being a large square building supported at each corner by massive towers. From the center of this arises the first tower, some fourteen or more stories in height and adorned along its outer edge by a series of statues. Surmounting this is a second and smaller tower, perhaps ten stories in height and adorned also with images of the gods. Above this is the light tower itself within which is kept burning during the night a great fire, visible, says, Josephus, some 300 stadia (about 34 miles) out to sea. The whole is surmounted by a great statue whose bronze surface gleams like burnished gold in the light of the rising sun. Correct, indeed, were the ancients in their judgment that this magnificent structure was to be regarded as one of the seven wonders of the world!

The Rhodians are naturally very much interested in this Alexandrian marvel since there was nearing completion in their own harbor a huge bronze statue of the god Helios. This also was to be classed as a wonder of the world and was to be known in history as the Colossus of Rhodes. Begun about the second year of the 118th Olympiad (302 B.C.) from the sale of the engines of war left by Demetrius Poliocetes when he lifted the siege of the city, the Colossus had slowly grown until it had reached the astonishing height of more than a hundred feet. This wonder of the world was prostrated finally by a violent earthquake in 224 B. C., but its huge fragments remained for many years and excited the astonishment of Pliny (A. D. 23-79) several centuries later. They were finally removed in 656 A. D. by the Saracens who sold the remains to a dealer in old metal. Nine hundred camels, it is said, were required to remove the fragments.

“And who is the author of this great work?” asks one of the Rhodians. “Certainly he has made here a structure worthy of the triumph of our own architect, the famous Chares of Lindus.”

The master, who is a native of Alexandria, swells with pride at this question and answers: “If on your visit here you go to the island you will find an inscription at the base in letters a cubit high which reads: ‘Sostratus of Cnidus, son of Dexiphanes, on behalf of mariners, to the divine Saviors.’ Since the tower has been erected, we have noticed here that the Dioscuri [Castor and Pollux] have been much kinder to those caught by night upon the sea.”

As we chatter thus the boat rapidly nears the shore. Our course is now held so as to keep the lighthouse on the right, for thus were we able to enter the harbor between Pharos and the rocky promontory known as Lochias. The site of Alexandria had been chosen originally because of the great advantages which the island of Pharos provided for harborage. Being at its nearest approach about 1400 yards from the shore, the construction of a great embankment, known as the *Heptastadium* [Seven stadia]¹, formed two separate harbors, one opening toward the north-east and the other toward the south-west. The first, into which we are now entering, was known as the *Great Harbor*, and the second, connected through the embankment by two small channels bridged by causeways, was known as the *Eunostos Harbor*, that is to say, the *Harbor of the Happy Return*.

But if the first sight of Alexandria has filled us with wonder, the second sight is fully in keeping with what the Pharos tower has prepared us to expect. The entire shore line from the promontory of Lochias to within a short distance of the Heptastadium was lined with marble structures. The palace of the kings first greets our eyes, towering in sheer magnificence from the promontory of Lochias and extending itself along the shore line toward the east. What a magnificent setting for the dramas that were to be enacted there!

And next to the palace area, hugging the shore in the embrace of its two arms, is the tiny island of Antirrhodus, which forms a natural small harbor for the use of the vessels of the kings and their retinues. Behind it upon the high ground is the *Theater* opening upon the sea

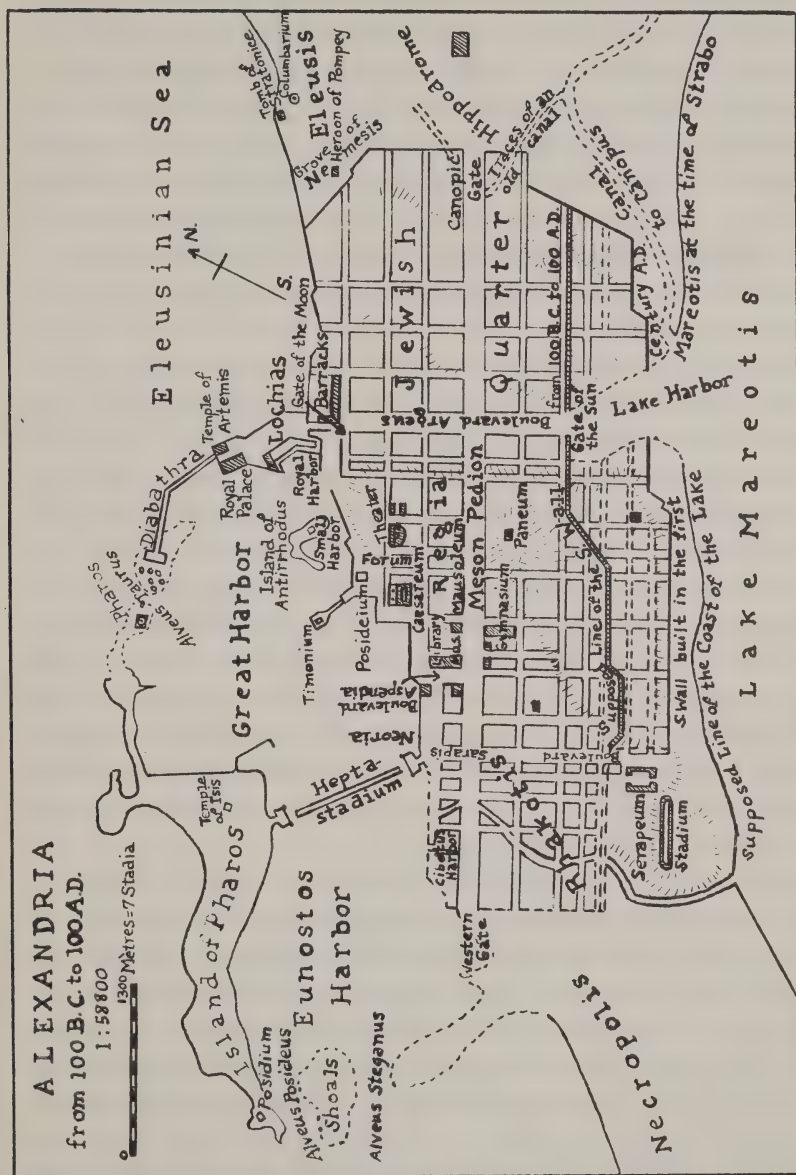
¹ Seven stadia = 1414 yards.

and forming an ideal setting for the pageants so dear to the pleasure-loving Alexandrians. Not far from the Theater and just visible over the western arm of Antirrhodus stands in solitary beauty the *Temple of Poseidon*, a fitting shrine to protect those who sail each day from the harbors out into the great domain of the god of the sea. Behind this and to the west are the public buildings, the *Museum* which we shall visit in due time, with its series of arcades, its assembly rooms, its dining hall, and the great *Library* close to the sea, the huge *Gymnasium* and the *Courts of Justice*, with their groves and gardens which adjoined it, and behind on higher ground as a sort of acropolis the *Paneum* or *Temple of Pan*. Built for the most part of white marble and adorned with sculpturing the equal of any produced in the Hellenic world, these buildings with their gay flower gardens and their flights of marble steps in a setting of broad, colonnaded streets, and seen by the light of a brilliant African sun, form a picture that is excelled by no other city of the ancient world. Not even Babylon with her hanging gardens, nor Athens with her acropolis, nor Pergamum with her temples, nor Antioch with her paradise of Daphne can match this gem of Egypt.

2. *The Boulevard Argeus.*

Since we bear letters from the king of Rhodes to Ptolemy Philadelphus, our ship puts in to the king's wharf behind the island of Antirrhodus, which, as one may well imagine on the eve of the great festival, was even at that early hour bustling with activity. Our vessel is met at the wharf by an official who examines our credentials and summons a guard to direct us to the palace.

Because of the credentials which we have with us we are kindly received by no less a person than the *dioketes* himself, a man by the name of Satyrus, who is the chief steward of the royal palace and, we are told, has control of the vast financial resources of the king. Comfortable quarters are given to us in a part of the palace which overlooks the sea and we are told that we may have the freedom of the city and that we are to dine in the king's hall during our visit to Alexandria. The king, it seems, is very friendly to scholars from foreign cities and he seeks, wherever he may find them, new books for the great library in which he takes a special pride. Our gift of



Map of ancient Alexandria compiled from the maps of several authorities. Since the old city has never been excavated the reconstruction must be made principally from literary sources.

a few rolls from the scholars of Rhodes will provide an open road to the king's heart.

Since the day is young, we eat a light breakfast of bread and fruit and unmixed Mareotic wine for which this region is justly famous, and set forth to see the city about which we have heard so much. Although this is the month of February, the sun is warm and the cool breeze from the ocean invigorates our bodies. The gardens are brilliant with flowers and the acacia trees are in full bloom. There is a hum of activity within the walls of the palace gardens, for the workmen are putting the finishing touches to the great hall that is being constructed for the banquet which is to follow the festival. This we shall visit in due time.

We proceed first to the gate of the Moon [*Selene*] which opens upon the magnificent avenue known as the Boulevard Argeus. This thoroughfare extends south for a mile and a half through the center of the city and terminates at the Gate of the Sun [*Helios*], through which one must pass in order to reach the harbor of Lake Mareotis.¹ It is one of the three principal streets of Alexandria and by the industry and planning which has made Alexandria one of the most beautiful cities in the world, the sight that greets our eyes is astonishing enough. The avenue is about 100 feet in width and is lined on both sides by colonnades. As we walk south along it we see on our right hand the buildings of the area of the *Regia*, a symphony in marble, terminating in the palace of the *Dicistery*, where the courts of law are located. On our left hand stretch interminably to the walls of the city the dwellings of the Jewish quarter.

Proceeding down this magnificent boulevard, we come at length to the main thoroughfare of the city, the famous Street of Canopus, or the *Meson Pedion*, which extends some three miles from the Gate of Necropolis on the west to the Canopic Gate on the east. Were we to proceed along this great avenue we should pass through the Jewish quarters to the city wall and thence out upon a sandy plain sloping toward the sea. Here we would find first the great Hippodrome where

¹ Authorities differ as to the exact location of the two gates, but one of them, at least, was associated with the Great Harbor. We follow the authority of G. Botti in *A History of Egypt under the Ptolemaic Dynasty* by J. P. Mahaffy, London, 1899.

the Alexandrians are treated to chariot races and other track events in their leisure moments. Beyond this is the Grove of Nemesis and not far away the settlement of Eleusis which is devoted to the entertainment of the Alexandrians, a kind of Coney Island, where there is revelry by night. Eleusis, says Strabo, "is a colony near Alexandria and Nicropolis and it is situated upon the Canopic canal; it has dwellings and prospects for those desiring revelry, both men and women, and is the beginning of the 'Canopic' life and of the wantonness which prevails there."

Apparently the entire region east of the city is devoted to amusement, for if we continue down the road we come to Canopus itself, another center devoted to the reveler. "Canopus," says Strabo, "is a city one hundred stadia [about 14 miles] from Alexandria, if one goes by foot, and was named for Canopus, pilot of Menelaus, who died there. The city contains the temple of Serapis, which is honored by many rites and which effects such cures that notable men both believe in it and sleep there in their own behalf, or have others sleep there for them. Some writers have recorded the cures and others the excellence of the oracles there. In contrast to this, however, is the crowd of revelers, who go by canal from Alexandria; for every day and every night the city is filled with people who play the flutes on the boats and dance licentiously with extreme intemperance, both men and women, and also with the citizens of Canopus, who have lodging places situated near the canal with suites for such license and entertainment."

3. *Lake Mareotis.*

But we do not turn aside to visit these alluring pastures. Instead, we continue south along the Boulevard Argeus to the Gate of the Sun, where we get our first view of the great lake harbor of Alexandria. Before us stretches a magnificent body of water, for in the days of the Ptolemies Lake Mareotis covered an extensive area and was replenished each year by the inundations of the Nile. Its longest extent was toward the southeast, a distance of some 300 stadia [34.5 miles], says Strabo, where it terminated in a large canal that leads to Naucratis on the Nile and affords passage for boats coming down from Upper Egypt. Separated from the sea by a narrow barrier of land,

Mareotis in its shorter dimension extends toward the southwest from Alexandria and toward the northeast in the direction of Canopus, its greatest breadth being about 150 stadia [17 miles].

Half way across the lake in the direction of Naucratis there are a number of large islands and about these and in the shallow water along the edge of the lake there grow great byblus reeds from which comes the famous papyrus of the Egyptians, and the cyamus, or bean, from whose seed-vessels drinking cups and bowls are made and sold in the shops of Alexandria. Although the byblus is a bare stock with a tuft on top, the cyamus is a beautiful plant with luxurious leaves and flowers and a large pod containing beans much sought after for food. Theophrastus in his work on *Plants* describes them thus:

“In Egypt the bean grows in swamps and marshes. Its maximum length of stalk is four cubits [6 feet]; it is an inch thick, and resembles a pliant, unjointed reed. Inside are separate tubes throughout its length, like a honeycomb. Upon the stalk are the heads and blossoms, double the size of a poppy; its color is that of a dark rose. From the stalk grow large leaves, and the root is thicker than the root of the thickest reed, and is made up of distinct tubes, like the stalk. It is eaten raw, or baked, being used as food by all who live near swamps.”

As one might well imagine the harbor is seething with activity in anticipation of the great festival scheduled for the morrow. Gaily decorated boats with festive crowds are to be seen upon the lake. From the king's triremes anchored in the harbor comes the sound of martial music; and smaller craft move hither and yon among the great war vessels. As we stand watching the colorful scene three grain ships enter the harbor from their journey down the Nile and thence through the canal from Naucratis, the path taken by much of the wealth which flowed into the treasury of the king. Here and there about the harbor we also notice a number of gayly colored cabin-boats and we are informed by our guide that these are the pleasure craft of the Alexandrians, who on holidays hold feasts in them within the shade furnished by the great bean plants of which we have already spoken.

4. *The Trip by Canal.*

Since we are weary from walking by this time, the guide suggests that we might return to the heart of the city by way of the great canal in one of the small boats which ply it. This seems an admirable suggestion and for an obol we obtain a ready oarsman. This remarkable aquaduct, called the *Canal of Alexandria*, opens from Lake Mareotis at the Gate of the Sun and flows in two directions, the eastern branch toward Canopus where it finally finds its way into the Nile, and the western branch around the southern boundary of the city and finally through a subterranean duct into the Eunostus Harbor. Time has effaced the last vestiges of this ancient water way, but it was certainly not the least of the marvels of Alexandria.

As we near the southwestern edge of the city on our journey along the canal there appears upon our right hand a breath-taking sight, the magnificent *Serapium*, or *Temple of Serapis*, said by those competent to judge, to be excelled by no other building in the world except the Capitol at Rome. The grandeur of this edifice is enhanced by its position upon an artificial elevation one hundred steps above the level of the city. It stands at one end of the great Boulevard of Serapis, which, running northward from the Temple, intersects the Street of Canopus at right angles and finally joins the Heptastadium connecting the city with the Isle of Pharos.

At this point the canal turns abruptly northward and separates the area of the Serapium from the Necropolis, which, with its gardens and mausoleums, covers an extensive space west of the city. Here also, close to the bend in the canal, is the *Stadium* where public games are held. In later times this part of the city was apparently abandoned as a recreation center in favor of a suburb known as Nicropolis some three miles east of Alexandria on the sea, which had a stadium and an amphitheater where, says Strabo, the quinquennial games were held.

Not far from the place where the canal turns northward it plunges below the level of the city. Through the dark vaulted tunnel we pole our way and finally emerge into the neighborhood of the markets and warehouses which line an inner harbor called *Cibotus*, or *the Ark*, that connects with the great harbor of Eunostus.

From this market area we now turn south again to the great Street of Canopus, one hundred feet in width and three miles in length, which we enter near the western gate. What an amazing sight it is with its great colonnades as far as the eye can see and its magnificent public buildings on either side. One of the most beautiful of these is the *Gymnasium*, which, says Strabo in his account, "has porticos more than a stadium [600 feet] in length."

Today, on the eve of the festival, the street, despite its great width, is packed with people, some on horses, some in chariots, others in palanquins, whose brilliant adornments and rich curtains show that they come from the palaces of the rich. There is a sudden shout and the crowd gives way as a string of elephants lumbers down the avenue toward the menagerie grounds which occupy part of the public gardens near the Museum. These great beasts, native African elephants, are to form part of the pageant on the morrow.

The crowd increases. Soldiers in gay uniform, native Egyptians, people from colorful Syria, Jews who form an important part of the populace, haughty Macedonians who comprise the ruling class, and visitors gayly clad in the garbs of distant lands, attracted here by this exceptional festival, mingle in a good-natured throng. Perhaps, indeed, it was of this very day that Theocritus was thinking when he put into the mouth of Praxinoë the following words:¹

"The gods preserve us, what a crowd!
How shall we elbow through it all? They're like
A swarm of countless ants. O Ptolemy,
Many the glorious deeds that you have done
Since when your sire was numbered with the gods!
No rascals now skulk up, in the Egyptian way,
To maul the passer-by, as once they did,
The lumps of villainy, the knavish tricksters,
All 'birds of a feather' — scoundrels one and all,
Oh, Gorgo, dear, what *will* become of us?
Here are the king's own chargers. — My good man,
Don't tread on me! — That chestnut's rearing up,
Oh, see how fierce it is! Run, Eunoë, hussy,

¹ *Idyll* xv.

Run! It will kill its leader. What a blessing
The babe's at home!"

5. *The Great Museum.*

Since the sun is now high and we have seen all the marvels that can be crowded into a single morning, the guide suggests that we seek some place for luncheon. But the great throngs in the city have filled the eating places to overflowing, so our thoughts turn to the great dining hall of the Museum which is only a few squares away. As guests of the king and as scholars from a distant shore, it is quite possible that we may find a welcome there. This suggestion is well received and we wend our way through the crowds toward the noble temple of learning which we have come so far to see.

And now at last we stand before it in an area just off the Boulevard Aspendia. To the southward are the extensive *Public Gardens*, where the Alexandrians bring their children on holidays to see the animals. To the eastward is the sacred precinct of the *Sema*, wherein lies the tomb of the city's founder, Alexander the Great, and the tombs also of his general, King Ptolemy, Soter, first ruler of the Alexandrians, and his wife, Queen Berenice. This place we shall visit on another day.

The lofty monuments of the golden city have long since vanished. Scattered rubble, fragments of brick and stone, a few ancient and time-worn relics buried twenty feet or more beneath the surface of the earth are all that mark the glories of which we write. But the memory of the great Museum is still fresh in the minds of men and it will remain a cherished memory in all the time to come. For here, perhaps, more than at any other spot in the ancient world, not even excepting the Lyceum of Athens, was the first home of scholarship and learning. Here was the first great library and here, also, was a place where men of ideas could congregate and write and think and explore the mysteries of nature. For a thousand years this was to be the first shrine of the Muses; hither turned the poets and the historians of the ancient world; hither came the philosophers and the mathematicians, the astronomers and the medical men, the physicists and the geographers. Through the halls of this great Temple sounded the footsteps of almost all the thinkers of the Hellenistic world and

of the Roman world that mingled with it. It is because of this shrine of the Muses that the history of Alexandria is a history of the culture of ancient times and of the origins of the best in modern civilization. The sights which we have seen in our trip through the golden city are, after all, but sights that tourists in other times have seen in otherlands. But the Museum is the unique spectacle of Alexandria, the "monument more enduring than bronze," of which the poet Horace wrote, because the activity within its walls is the most significant to the modern world.

Timon of Phlius,¹ a sour critic, who saw through envious eyes the philosophers of the Museum as well-fed chickens in a coop, once wrote as follows:

"In the thronging land of Egypt,
There are many that are feeding,
Many scribblers on papyrus
Ever ceaselessly contending,
In the bird-coop of the Muses."

But time has vindicated the Museum. Though much there doubtless was of pedantry and worse, the scribblers on papyrus have left us a vision of the highest ideals of scholarship. Our own great universities are for the most part but modernized replicas of those ancient halls of learning. Nor, indeed, is there a university in the world that would not envy the faculty which in the reign of King Ptolemy Philadelphus directed the destinies of the Museum and produced its manuscripts.

We are kindly received at the Museum and are put in charge of a preceptor whose name, we discover, is Callimachus, a remarkable young man about thirty years of age. Those who are familiar with the history of Hellenistic literature will need no introduction to Callimachus, for he it was who finally became the dictator of letters in that famous school. We meet him here at the beginning of his career, fresh from his studies in Athens where he was a pupil of Praxiphanes, the Peripatetic philosopher, from whom he had absorbed the culture and the enthusiasm of the Greek domain.

¹ Athenaeus, i, 22.

6. *Luncheon with Euclid.*

The luncheon hour is at hand and the scholars are coming into the dining hall both singly and in groups. Disputations are obviously in progress as we may judge from the intensity of interest on the faces of some. Perhaps they involve the interpretation of an obscure passage in Hesiod, or the use of the aorist in Homer, or the distance of the stars above us, or whether the liver is the seat of man's affection. For these are scholars much like those of other lands and times and their tongues clack over the same problems and will till the last trump.

"Come with me," said our preceptor. "I see a table at the far end of the hall at which you may expect a treat. For there is the grand old man of the Museum, our first scholar. Even in Rhodes you have doubtless heard of Euclid."

And there, indeed, was the Father of Geometry himself, a kindly old man, who had been brought many years before to Alexandria by the first Ptolemy to found the school of mathematics. Time had not dimmed the sparkle in his eyes nor erased the dreamy speculation which characterized his mien. Here was the man whose scrupulous fairness to his colleagues and whose kindness to students under him was to live in the memory of men who came after him. Here was the author of the immortal *Elements* of Geometry. "This wonderful book," says Sir Thomas Heath,¹ "notwithstanding its imperfections, remains the greatest elementary textbook in mathematics that the world is privileged to possess. Scarcely any other book except the Bible can have circulated more widely the world over or been more edited and studied. Immediately on its appearance it superseded all other *Elements*, and that so completely that no others have survived."

Eagerly we ply the great scholar with questions when we find that he is as human as tradition has painted him. Is it true that, when Ptolemy asked him for a short-cut into his subject, he made reply: "there is no royal road to geometry?" And did Stobaeus give a truthful account of the incident, when a student who had come to study geometry under the master, having completed the first theorem, then asked: "What shall I get by learning these things?" And thereupon

¹ *A Manual of Greek Mathematics*. Oxford, 1931, xvi + 552 pp; in particular, p. 204.

did Euclid call a slave and say: "Give him a coin, since he must needs make gain out of what he learns?"

These questions please the old scholar and he grows expansive and tells us much more about the Museum and its founding in the reign of the first Ptolemy. It seems that the idea originated with Demetrius Phalereus (c. 345-283 B. C.), the famous Attic orator, statesman, and philosopher. Born at Phalerum, a city close to Athens, he migrated to the capitol, where he became a pupil of Theophrastus and an adherent of the Peripatetic school. In the course of time he gained political power and for ten years from 317 B. C. he governed the city of Athens as the representative of Casander, the ruler of Macedonia. Although there is some doubt about the character of his administration, he so endeared himself to the people that 360 statues were erected in his honor. But so fickle a jade is Fortune, who gives power with one hand and steals it away with the other, that no sooner had the old democracy been reëstablished in Athens in 307 by Demetrius Poliochres, than the same citizens who had honored Demetrius before, now turned upon him and condemned him to death. He fled to Alexandria and was protected there by Ptolemy Soter. To the king, it is said, he suggested the founding of a library and from this project naturally developed the Museum itself. And what finally became of Demetrius? Report has it that he fled to Upper Egypt when Ptolemy Philadelphus came to the throne for Demetrius had promoted the interests of Ptolemy Ceraunus [the Thunderbolt], his brother and the logical successor to the throne, but a man of fiery and violent ways as his name signifies. Demetrius died three years ago, we hear, from the bite of an asp, but whether by design or accident we do not know.

By this time the food is being served by the slaves and we are interested to observe that the scholars of the Museum are well provided for by the administration of the dining hall. The meal begins with a bowl of lentil soup, a dish so common among the Alexandrians that it is often parodied by the comic poets. This is followed by a large platter of crow fish from the Nile, garnished with leaves of lettuce, a flat fish sweet and tasty and a favorite on the tables of the Alexandrians. A steaming bowl of what we would call stew is then brought in, a mixture of meat boiled with cabbages and onions. The latter has an excellent flavor, but we notice that the cabbage is bitter,

a quality which we understand is produced by the soil near Alexandria. This dish is served with barley cakes of a peculiarly pleasant flavor. From this we pass to cheese, garnished with large olives, and thence to fruit and a copious helping of rich white wine. This wine, we understand, comes from the vineyards which grow abundantly along the edge of Lake Mareotis and is so much sought after in other places that the name *Mareotic wine* is a symbol of high excellence.



“There is the tower of Pharos, shimmering in white marble, one story piled upon another.” (From an early reconstruction).

This wine, says Athenaeus, “is pleasant, fragrant, easily assimilated, thin, does not go to the head, and is diuretic.”¹

“And how did you attain such great perfection in your *Elements*?” we ask of Euclid. “There seems to be no predecessor, which is unusual in a work that needs so little editing.”

This greatly pleases the sage. One’s children may have big ears, misshapen noses, and dull intellects, but do not mention these im-

¹ Athenaeus, i, 33.

perfections if you would keep our friendship. And much truer this is also for the children of one's brain, where the bad passages, the ill-drawn conclusions, and the errors of fact and fancy stand out so boldly in the published work. Rather, indeed, speak of those perfections which may be detected and the pleasing paragraphs, if any can be found. Then, most quickly, will you gain our everlasting affection and perhaps, with it, an invitation to dinner.

"Long ago I began my studies in Athens in the school of the great Plato," Euclid replies, "that famous school above whose door you read, '*Let no one ignorant of mathematics enter here.*' Plato had died before I began my studies there, but the spirit of the master still lived among his pupils. And in that pleasant spot I early became acquainted with the writings of Eudoxus. On every page of mine you will find the footprints of that master; from Aristaeus I learned about the conic sections; and from the Pythagoreans I discovered much about the nature of number and the mysteries of those quantities whose squares are 2 and 3. Then, too, there was always before us in Plato's school the theorem of the five Platonic solids. You will recall, perhaps, that curious fact wherein, by the nature of things, we prove the existence of regular solids of four, six, eight, twelve, and twenty faces, but no other. With that grand theorem, you may remember, I bring my *Elements* to its close."

From which you see that Euclid was as history has pictured him, a kindly and generous man, who claimed few things for himself and gave to others the glory that was theirs.

"From simple things," says Euclid, "we build to greater things, from points to lines, from lines to planes, from planes to solid figures. And back of all there are simple thoughts common to every one. And man would live the better if he could build his life on a principle like that."

There are many other questions we wish to ask him, as, for example, his own opinion concerning that famous fifth postulate about the nature of parallel lines. It will be recalled that this postulate led to storms of controversy for twenty centuries and more, — storms which ended finally in the creation of new and astonishing geometries not dreamed of by Euclid and his colleagues. But the old man is weary and we let him go. We watch his figure as far as we can see it

and turn away at last with far more reverence in our hearts than we have felt for any king.

7. *We Visit the Library.*

The luncheon over, Callimachus now suggests that we may enjoy a visit to the great library, an invitation which we accept eagerly. We pass from the dining hall into the gardens and thence along a walk through a series of arcades, spacious exedra with seats where the members of the Museum could engage in arguments, thence past the assembly halls where rooms were provided for lectures and other gatherings, and finally to the library itself at the north end of the enclosure not far from the sea. "There it towers," says Charles Kingsley in *Hypatia*, "the wonder of the world, its white roof bright against the rainless blue; and beyond it, among the ridges and pediments of noble buildings, a broad glimpse of the bright sea."

We are introduced here to Zenodotus, a man about 45 years of age, who had been appointed by Ptolemy Philadelphus as the first superintendent of the library. A learned man is he, a native of Ephesus, and a student of the poet Philetas of Cos. As a grammarian and critic he has had few rivals and he is now at work on his critical edition of the works of Homer, which was to appear in 274 B. C. We learn from Callimachus that he is famous also as a lecturer and that his special themes are Hesiod, Anacreon, and Pindar.

The library is humming with activity for Ptolemy has diverted part of his vast wealth into a search for scrolls throughout the entire world. Ships, it is said, are searched in the harbor for manuscripts and every device that could be invented by an ingenious and wealthy monarch is employed to add to the growing store of literary treasure. We are informed that there are now nearly 400,000 volumes in the library and the collection has grown so fast that Ptolemy is building another library near the Serapium.

We are introduced to two assistants, Alexander of Aetolia and Lycophron of Chalis who are entrusted respectively with the arrangement of the works of the tragic and the comic poets. The former is himself a tragic poet and the latter had gained great renown some fifteen years earlier by a strange poem called *Alexandra*, which was full of curious allusions to mythology and obscure linguistic learning.

Because of our great interest in the library and the fact that we have brought additions to its growing store, we are invited to inspect the greatest treasure of all, no less than the library of Aristotle himself. According to the story, Aristotle was a great collector of manuscripts and by his efforts assembled the first library of which we have any record. These books were bequeathed by him to his disciple Theophrastus and thence by Theophrastus to Neleus, who, it is said, carried them to Scepsis and concealed them underground so that they would not be taken by the kings of Pergamum. These monarchs were emulating the Alexandrian rulers in their search for books. What happened to this library is open to much doubt, since Strabo says¹ that it was sold to Apellicon of Teos, who carried it to Athens, where after Apellicon's death it was seized by the conqueror Sulla and conveyed to Rome. But according to Athenaeus, Neleus sold the volumes to Ptolemy Philadelphus and they were taken to Alexandria to become part of the great collection there. Whether these are, indeed, the original books of Aristotle upon which we look we shall never know, but at any rate we examine with due reverence the beautiful scrolls.

8. *The God Serapis.*

It is past mid afternoon when we finally leave the precincts of the Museum and continue our exploration of the city. Crowds still throng the streets and we elbow our way in the direction of the Serapium which we desire to see more closely. And there at last it stands before us, an inspiring pile of white marble glistening in the light of the bright afternoon sun, its massive pillars and its frescoed porticos fashioned in the best of Grecian art.

We climb the hundred steps to the temple and enter the rectangular portico which encloses the sacred precincts. And now we are within the shrine itself and we gaze amazed at the great arches and the magnificent statuary. There, indeed, must be the work of Praxitelles, and Phidias, and Leochardes, and other heroes of Greek sculpture; for the vast wealth of the first Ptolemies was lavished on the arts, and many of the treasures of Greece were imported to Alexandria.

¹ *Geography*. xiii, 1, 54.

There in the center of the temple upon a great throne is the god Serapis himself, a massive image fashioned out of plates of metal and of such size that he touched both walls of the shrine. "The aspect of Serapis," says Gibbon¹, "his sitting posture, and the scepter, which he bore in his left hand, were extremely similar to the ordinary representations of Jupiter. He was distinguished from Jupiter by the basket, or bushel, which was placed on his head; and by the emblematic monster, which he held in his right hand: the head and body of a serpent branching into three tails, which were again terminated by the triple heads of a dog, a lion, and a wolf. It was confidently affirmed, that if any impious hand should dare to violate the majesty of the god, the heavens and the earth would instantly return to their original chaos."

And who indeed was this new god in the land of Egypt where from time immemorial Osiris and Isis had dominated the temples? Some say that he was imported by the first Ptolemy, when commanded by a dream, from the coast of Pontus, where he had been an object of worship with the people of Sinope. And others say that the wily king, in order to create a god who would please both his Egyptian subjects and the Macedonian conquerors, combined the Greek god Hades with the Egyptian Userhapi, that is to say, Osiris-Apis, in a new diety. However that may be, the great god Serapis appears as the presiding deity of the Alexandrians and through the many centuries of its glory watches over the golden city. And when the frenzied tumult of the last days grew into a torrent of destruction, this great symbol was at last torn from its throne and shattered into fragments by the mob. That savage scene we shall witness in due time.

The afternoon sun is low in the western sky when we leave the precincts of the Serapium and turn our thoughts toward home. But the guide suggests to us that there is one more sight which we should see, and that the cool of the evening is the time for us to view it. Near the center of the city and just south of the Street of Canopus there is an area containing the Paneum, or Temple of Pan, "a summit, as it were," says Strabo, "which was built by the hand of man; in shape it resembles a fir-cone, and is, in fact, a rocky hill, which

¹ *Decline and Fall of the Roman Empire*, Chap. 28.

is ascended by a spiral road; from its height one can see the entire city lying below in all directions." And so we climb this artificial hill and stand a moment before the temple door, reflecting upon the wisdom of the ruler who balances the worship of the somber god Serapis with a shrine to this woodland deity of mirth and music. And there below us is the golden city, a brilliant jewel alight in the rays of the setting sun, between the restless waters of the great ocean and the placid mirror of Lake Mareotis. And as we gazed from east to west and from north to south at the marble palaces, the beautiful gardens, and the swarming streets we felt like Achilles Tatius who exclaimed: "And at last, my vision unsatisfied, cried out in weariness, 'Ah, my eyes, we are vanquished!'"

9. The Great Festival Begins.

Before dawn we are awakened by the sound of trumpets for the festival is to begin at the break of day. We snatch a light breakfast and hasten out upon the streets which are already alive with the holiday crowds. For this is the day which will go down in song and story and will not be forgotten in twenty centuries.

Since we belong to the king's retinue we are accompanied by a guard, which shouldered a way through the throngs, and we finally reach the precinct of the stadium where the spectacle is to be shown. We find there that a pavilion has been set up for the king's household and we take our places on comfortable lounges to await the beginning of the procession.

Now there are many readers who have seen great public spectacles, endless processions of floats and symbolic figures, and clowns, and animals from all the corners of the earth; but we submit that in Alexandria some twenty-two centuries ago there was held the father of all the spectacles that have dazzled the sights of men. As the sun peeped over the eastern edge of the world, the magnificent pageant began and at its head was the Morning Star. And all day long there was the sound of marching feet for this parade of all parades did not end until Hesperus had set in the western sea.

The procession is formed in several parts or divisions, the first being devoted to the Morning Star. Then comes the section honoring the parents of the king and queen, Ptolemy Soter and his wife Bere-

nice, for it will be recalled that Ptolemy Philadelphus married his own sister, Arsinoe. Following this are the divisions devoted to Dionysus, Zeus, and other gods, and thereafter a display in honor of the founder of the city, Alexander the Great; and finally the division of the Evening Star, which was to bring the pageant to its end.

We shall not weary the reader with all the details which have come down to us through the account of Callixeinus of Rhodes in the fourth book of his work on *Alexandria* as it has been reported by Athenaeus; but one cannot fully appreciate the magnificence and wealth of the court of Ptolemy Philadelphus without witnessing some parts of the procession.

The division devoted to Dionysus, son of Zeus, god of the vineyards and of wine and revelry, worshipped by many under the name of Bacchus, is headed by a troop of Sileni, constant companions of the god in his frolics, droll fellows, dressed in riding coats of red and purple, who keep back the crowds from the line of march. And these are followed by a band of the inevitable Satyrs, woodland spirits usually represented as half-man, half-beast, who carry torches ornamented with gilt ivy leaves. And after these come Victories with golden wings, bearing censers nine feet in height, women dressed in richly embroidered tunics and laden with jewelry. Then appears a double altar to the god, appropriately decorated with his symbols, followed by a group of 120 boys bearing frankincense and myrrh and saffron upon golden platters. The Satyrs come again, with golden crowns upon their heads and bodies smeared with colored ointments, some in purple, some in vermillion, and some in other hues. And then, preceded by two Sileni, one with a herald's staff and the other with a trumpet, march a very tall man and a very tall woman. The man is called "The Year"; he wears a tragic costume and mask and carries a horn of plenty. The woman, selected not only for her height, but also for her striking beauty, is handsomely dressed in a rich tunic and is adorned with quantities of golden ornaments. She represents the "Five-years' Festival" whose inauguration we are now enjoying. After her come the Four Seasons with their fruits and more Satyrs in red tunics with wine-pitchers and goblets and the poet Philiscus, priest of Dionysus, accompanied by his train of actors. And there are also borne along the Delphic tripods, which are to be

given as prizes to the managers of the athletes, — musical instruments resembling a harp, which rest upon three legs.

But the plaudits of the multitude which have greeted these displays are now increasing and we crane our necks to see the next sensation. A sight it is, indeed, the first float, a four-wheeled cart, twenty-one feet long and twelve feet wide, drawn by no less than one hundred and eighty men. Here is the god himself, a statue fifteen feet tall, pouring a libation from a golden goblet. Dionysus is clad in a purple tunic which stretches to his feet and over this is a transparent saffron coat, and around his shoulders is a purple mantle spangled with gold. Above him is a canopy decorated with ivy, grapevines, and other cultivated plants; and hanging to it are "wreaths, ribbons, Bacchic wands, tambourines, fillets and satyric, comic and tragic masks." In front of the god there stands a huge golden mixing bowl holding 120 gallons, and a golden tripod with a golden censer and two dishes filled with cassia and saffron. This beautiful float is followed by priests and priestesses of the Bacchic worship and a horde of Macedonian Bacchantes, women with streaming hair, who clasp snakes and daggers in their hands. This wild sight recalls the words of the messenger in the *Bacchantes* of Euripides:

"Then all around,
Alert, the warm sleep fallen from their eyes,
A marvel of swift ranks I saw them rise,
Dames young and old, and gentle maids unwed
Among them. O'er their shoulders first they shed
Their tresses, and caught up the fallen fold
Of mantles where some clasp had loosened hold,
And girt the dappled fawn-skins in with long
Quick snakes that hissed and writhed with quivering
tongue."

A roar of approval now rises from the crowd and we view with increasing astonishment the next float, a four-wheeled cart drawn by sixty men. Upon it there is an image in honor of Nysa, the reputed birthplace of the god, the statue of a woman twelve feet in height, clad in a yellow tunic spangled with gold and wrapped in a Laconian shawl. When we see her first she is seated upon a throne, but as we

watch she rises automatically to her feet and pours a libation of milk from a saucer in her hand. Then gracefully she regains her seat again. And who, we ask, in the city of Alexandria could fashion so remarkable a device? Was it Ctesibius, the mechanic, forerunner of Hero, about whom we shall hear later? or was it some unknown genius whose name has been erased by time? We do not know.

Wonders pile on wonders. Here comes a float drawn by 300 men, a huge four-wheeler thirty feet in length and twenty-four feet wide, with an immense wine press full of grapes upon it. Trodden by the feet of sixty Satyrs the wine flows freely during the entire march and the Satyrs sing vintage songs as they go about their work. Even this great float is dwarfed by the next one drawn by 600 men. Upon it is a vast wine skin stitched from leopard pelts and the wine flows from it in a steady stream to the great delight of the multitude.

The excitement grows and there is much scrambling among the watchers for 1600 boys laden with golden and silver vessels of all descriptions scatter sweet-meats to the crowd.

But the largess of the king is not confined to these small gifts for here comes another float that is worth our attention. Drawn by 500 men it represents a deep cavern profusely shaded with ivy and yew in which lies the infant Dionysus. "From this," says Athenaeus, "pigeons, ring doves, and turtle doves flew forth along the whole route, with nooses tied to their feet so that they could be caught easily by the spectators. And from it also gushed forth two fountains, one of milk, the other of wine. And all the nymphs standing around [the infant] wore crowns of gold, and Hermes had a staff of gold, and all were clad in rich garments."

The pageantry which we have seen, however, is tame in comparison with what we are now about to see. For here comes the triumphal procession of the god, the pageant of Dionysus returning in glory from India. Nothing in the annals of the nabobs of the orient can compare with the splendor of this part of the procession. It is led by a huge float on which is represented the god reclining upon the back of an elephant gaily bedizzened in trappings of gold, a float which is followed by 500 girls with golden-pine crowns and 120 Satyrs panoled in gold, and silver and bronze.

10. The Animals March By.

The crowd roars with delight for here come the animals at last. Five troops of donkeys mounted by Sileni and Satyrs march by. These are followed by twenty-four elephant chariots, sixty teams of goats, seven of gazelles, fifteen of the African hartbeestes, eight teams of ostriches, seven of antelopes, four teams of wild asses, and four horse-drawn chariots. In these chariots are the children, feasts for the eyes of their parents, small boys as charioteers and small girls beside them with little lances and shields.

The camels come next, some of them laden with frankincense, myrrh, and the choicest spices of the east, — saffron, cassia, cinnamon, orris, and many others. Behind them march the negro tribute-bearers carrying tusks of ivory, huge logs of ebony, and mixing bowls filled to the brim with gold and silver coins and gold dust.

What a racket now falls upon our ears, the barking of dogs, the cry of birds, and all the sounds that one may hear in the vast forests of Africa. For here comes a procession of no less than 2400 dogs, "some Indian, the others Hyrcanian or Mollossian or of other breeds." Behind them march one hundred and fifty men bearing trees on which are suspended birds and small animals of all kinds; and following them come cages of parrots, peacocks, guinea-fowls, pheasants, and many of the other birds of Ethiopia.

The great zoo in the Public Gardens has other contributions to make, for now the other animals come marching by, — one hundred and thirty Ethiopian sheep, three hundred from Arabia, and twenty from Euboea. Included are twenty-six pure white Indian oxen, and eight from Ethiopia. What a roaring we now hear for the parade at last provides us with the savage animals, — fourteen leopards, sixteen panthers, four lynxes, three panther cubs, and twenty-four huge lions from the African deserts.

But our eyes can scarcely credit the next sight! For there in very truth is a bear with a white coat of fur, — a bear imported from the polar regions where snow and ice are found throughout the year. If we are not confounded before, this finally accomplishes it. For by what magic art did this remarkable king succeed in bringing a polar bear to Egypt? It may be conjectured that this animal was an albino,

but the evidence seems to indicate that it was, indeed, a polar bear. In wonder at this thing we almost forget to notice the giraffe and Ethiopian rhinoceros which now come by.

11. *The End of the Parade.*

The sound of singing falls upon our ears. Sweet and beautiful it swells into the open heavens, such a chorus as few have ever been privileged to hear. For now there arrives a choral band of six hundred men accompanied by three hundred harp players, whose golden lyres glisten in the sun.

When these also have passed by, the sound of lowing cattle falls upon our ears. And there before us is a great sea of animals, two thousand steers, all of the same color, with gilded horns, and golden stars upon their foreheads, and wreaths between their horns, and necklaces and aegises upon their breasts.

The scene now changes for the pageant of Dionysus has gone by and in its stead is the division devoted to Zeus and other gods. In breathless profusion come the symbols of their worship, thrones and floats and votaries in such an endless chain that our head whirls and we are fatigued by its sheer magnificence.

After these symbols of the gods there arrives that part of the carnival dedicated to the memory of Alexander the Great, founder of the golden city, and to Ptolemy Soter, its first ruler, and to his wife, the Queen Berenice. In this section of the pageant no detail has been omitted which would show the vast wealth and splendor of the ruling sovereign. We see first the image of Alexander himself, borne on either side by Victory and Athena, in a chariot drawn by elephants. Golden ornaments surpassing the dreams of Midas are shown, a crown upon the throne of Ptolemy Soter which was fashioned from 10,000 coins, and golden censers, and golden torches, and Delphic tripods, and wreaths of solid gold. Huge gilded palm trees are carried by, and a herald's staff, and a gilded thunderbolt some sixty feet in length, and figures of wild beasts and eagles, and a crown of gold one hundred and twenty feet in circumference, adorned with precious stones, which encircled the portal of Berenice's shrine.

As if this were not enough there follow wagons filled with golden and silver vessels and spices from the east. And after these, per-

haps as a royal guard, march the king's troops, some 57,600 men on foot and some 23,200 on horse, all royally dressed in the garbs customary to their ranks and armed from head to foot.

But doubtless you are now as weary as we are from the sheer splendor of this display and look with eager eyes for the Evening Star which is to close the great procession. There it comes at last, trailing the final glory of the day, just as the sun touches the western edge of the world.

Now all of this has been set down by Callixeinus, as we have said before, and surely he has described for us the most dazzling spectacle that was ever made by any monarch for the entertainment of his subjects. Croesus himself might shudder at the cost, for it is said that the total expense of this huge carnival was equal in amount to 2,239 talents and fifty minas of silver, a sum that in the present day would probably amount to some three and a half millions of dollars.

Whence came this vast wealth that could be lavished upon a single pageant on a single day? We do not know, but it is probable that the gold and silver, which fell to Ptolemy Soter as his share of the treasures of Alexander gathered in Babylon and the east, was at the basis of the fortune. But there have also floated down the Nile the grain ships of bountiful Egypt; and into the three harbors have come the vessels from many lands laden with all the treasures of the earth. Be that as it may, we have witnessed such a spectacle today as few monarchs in the history of man could have afforded to present to their subjects.

12. *The Banquet Pavilion.*

With the setting of the sun the festivities are by no means at an end, however. The wine has flowed freely all day long and with evening comes the time for feasting and merriment. But we shall leave the Alexandrians to their pleasures, and return to the palace to rest a moment in preparation for the entertainment which the king has promised us.

Since we are guests in the Royal Palace we have been included in the invitations issued by the king to his banquet. This is to be held in a special pavilion which he had had constructed for the

festival. This building is itself in keeping with the other lavish displays that we have already seen in the procession.

The pavilion is built of generous size commodious enough for two hundred guests. The roof is supported by a series of wooden columns about seventy-five feet in height, five on each long side and four on the others. The corner columns are cleverly fashioned to represent palm trees and the others Bacchic wands. Along the top of these columns there are square epistyles supporting the roof, which is draped with a circular canopy of scarlet edged with white. The lateral beams are draped in white tapestries and between them are appropriately painted panels. Outside the columns there are porticoes on three sides of the pavilion where the retinues of the guests could stand. The entire structure is enclosed by magnificent purple curtains decorated on the outside by branches of laurel and myrtle and other boughs and inside by pelts of animals of all descriptions.

The sight that greets our eyes as we enter the pavilion is astonishing enough for the floor is a mass of flowers scattered in the greatest profusion, roses, acacia blossoms, orange colored wall-flowers, jasmine, narcissus blooms and all the others found in that luxurious region even in the winter season.

Ptolemy has decorated the interior of the pavilion with the same profligacy that has characterized the rest of the celebration. One hundred marble statues have been placed around the four corner pillars. The walls are decorated with golden tunics and military cloaks into which had been woven the portraits of kings and scenes from mythology. Above these are rows of oblong shields, alternating gold and silver, and higher yet, there have been cleverly fashioned recesses in which are represented drinking parties and other scenes with figures taken from the theater. Between these recesses are niches adorned with golden Delphic tripods. Along the topmost part of the pavilion are eagles fashioned of gold, huge birds about twenty-two feet in size.

One hundred golden couches with feet shaped like Sphinxes are arranged along the two sides of the pavilion. Upon them heavy woolen rugs, purple in color, have been spread, and beautifully embroidered counterpanes are placed over these. Two three-legged tables of gold are set at each couch for the use of the guests and

behind them are one hundred silver basins and the same number of pitchers for handwashing. In the center of the pavilion there is another couch laden with goblets and cups and the other utensils to be used at the banquet. These are all of gold and studded with precious stones.

One side of the pavilion is open for the entry of the guests and from this doorway to the couches are Persian carpets woven with exquisite skill. The effect of all this, as one may readily imagine, is to make us believe that we have been transported to the palace of an Arabian fairy-tale.

13. *Art in the Golden City.*

But the Rhodian scholars are much more impressed by the sight which we have reserved to the last, the magnificent series of pictures that have been hung between the columns. These are from the artists of the Sicyonian school in Greece, whose founder was Eupompus, a native of Sicyon. This illustrious artist instructed Pamphilus and he in turn became the teacher of Apelles of Cos, who, says Pliny¹, "surpassed all the other painters who either preceded or succeeded him." Here indeed Hellenic culture reaches one of its highest points. The stream of time has washed away those glorious colors and only the memory of them has come down to us in futile words. Now at last we stand in the presence of those famous works.

Many are the tales that have been told to us of Apelles, who flourished in the court of Philip II of Macedonia and became friends with Alexander the Great, whom he painted holding a thunderbolt. According to Pliny it was his custom sometimes to conceal himself and to expose a completed picture to passers-by so that he might benefit by their criticism. It was under these circumstances that a shoemaker once pointed out an error in one of the shoes. When on the next day, elated at seeing the mistake corrected, the cobbler began to criticize other parts of the picture, Apelles came forth and strongly urged that the shoemaker "stick to his last."

So great was Apelles' skill in portraying what he saw that he excited the envy of his rivals. On one occasion, according to the

¹ *Natural History*, xxxv, 36.

story, he submitted the picture of a horse in a contest. When the judgment was about to go against him he suggested that each picture be shown in turn to real horses in order that a natural judgment be given. Thereupon, says the tale, when the picture of Apelles was shown to them, the horses began to neigh.

It is not altogether improbable that Apelles may once have been in Alexandria. At any rate Pliny tells the following story¹:

"Apelles was not in good favor with Ptolemy while he was serving in the retinue of Alexander. It so happened that the artist was driven by a violent tempest to Alexandria, where Ptolemy was then ruling. Bribed by envious rivals, the court jester was persuaded to issue an invitation to Apelles to attend the king's banquet. When the artist came to dinner the indignant Ptolemy paraded before him his stewards so that he could say who had issued the invitation. Seizing a piece of quenched charcoal from the hearth, Apelles drew a picture on the wall and the face of the jester was immediately recognized by the king before it had been completed."

One of the most remarkable pictures of Apelles was that of *Calumny*, a description of which has been preserved for us by Lucian in his essay of the same name. Thus says Lucian: "Apelles, in commemoration of the dangers he had run, revenged himself upon Calumny by a picture of the following character. On the right sat a man with enormous ears, just like those of Midas, stretching out his hand to Calumny approaching him from a distance. About him stood two women — Ignorance, I suppose, and Suspicion — and from the left side Calumny is arriving, a very handsome female, but heated and excited, as if she were exhibiting frenzy and rage, with a burning torch in her left hand, and with the other dragging by the hair a young man stretching out his hands to heaven and appealing to the gods. A male figure leads the way, pale and unsightly, peering sharply, and like those who are reduced by a long sickness. You could guess it to be Envy. Two women follow in attendance on Calumny, setting her off and adorning her. As the guide told me, one of them was Conspiracy and the other Deceit. But behind them followed some one in deep grief, with black garb and disheveled hair. I think she was called Repentance, and she

¹ *Ibid*

was turning back in tears to look with great shame on Truth, who was approaching."

Although this picture like all the others has disappeared, the Florentine painter Sandro Botticelli (1444-1510) translated the words of Lucian back upon canvas and we have today in his picture *La Calumnia* some idea, perhaps, of what Apelles was trying to portray.

But by this time the guests are beginning to arrive, men and women, whose gorgeous robes with their gold and jewels scintillate in the light of the many torches and hanging lamps.

14. *Their Majesties, the King and Queen.*

Suddenly there is the sound of trumpets and the voices of the guests are hushed. Here at last comes the king himself accompanied by his sister, Queen Arsinoe of Thrace and Macedonia, who, we hear, has just fled to Egypt to escape the violence of her husband and half-brother, Ptolemy, the Thunderbolt.

We gaze with the greatest interest upon the royal pair for famed they both are in song and story. King Ptolemy is at this time a young man for he was born in the year 309 B.C. Although he bears a general resemblance to his father, his features are more regular and he has not inherited the robust physique of the old king. His hair is light, his health not of the best, and there is a thickness about his neck which hints at an inclination toward the obesity which was to become a striking characteristic of later Ptolemies. His philosophy of life had been inherited from the Epicureans, particularly as it found interpretation in the famous school at Cyrene. This asserts that pleasure is the highest form of existence. His interpretation of what was pleasure was not always of the best, but he enjoyed the society of learned men and was undoubtedly one of the greatest patrons of scholarship that the world has ever known. Luxurious living, however, finally got the better of him. It is told by Athenaeus¹ that once, when he was recovering from an attack of the gout, he spied some Egyptians sprawling on the sands and eating their lunch of plain food. Whereupon he cried out: "Un-

¹ xii, 536

lucky devil that I am! To think that I cannot even be one of those fellows."

Queen Arsinoe, a few years older than the king for she was born in the year 316 B.C., was a lady of striking beauty, imperious of mien, and patrician in both looks and action. That she possessed a fascination not dissimilar to nor less effective than that of her famous kinswoman, Cleopatra, is attested not only by the large political influence which she wielded, but also by the excessive grief of the king at her death.

Her story, which is told us, is one of tragedy. At last, however, her fortune is secure and she is to rule for the next quarter of a century over the most brilliant court in the Hellenic world. It seems that she was first married to Lysimachus, king of Thrace, who made over to her the territories taken from his divorced wife. Plotting with her half-brother, Ptolemy Ceraunus, the Thunderbolt, who had recently arrived in the Thracian kingdom, she contrived to poison the mind of Lysimachus against Agathocles, her stepson, and he was condemned to death. The brother, widow and children of Agathocles immediately fled to Seleucus, ruler of Asiatic domains of the Macedonian empire, who declared war on Lysimachus. In the battle of Korupedion the latter lost his life and Queen Arsinoe fled with her two youngest sons to Cassandreia. In the meantime, Ptolemy the Thunderbolt had joined forces with Seleucus; but no sooner had that monarch achieved his successful battle than the Thunderbolt slew him and proclaimed himself the king. This violent man now marched upon Queen Arsinoe. Instead of using military means to achieve his conquest, he proposed marriage to the widow. No sooner had she accepted his offer, however, and the Thunderbolt had secured possession of her territory, than he murdered her two young sons and banished his new wife to Samothrace. From there, however, the unhappy and disillusioned queen managed to escape and fled to her brother's court in Alexandria. Here at last she was finally to be acclaimed the Queen of Egypt.

Many were the shrines dedicated to her in later years throughout Egypt. Numerous towns were named in her honor, and one of the territorial divisions of the empire was called the Arsinoite nome. Between Alexandria and the Canopic mouth of the Nile upon a

promontory there was erected a temple to her by Callicrates, commander of the king's naval forces, where she is identified with Aphrodite Zephyritis, as we know from the following epigram of Poseidippus¹:

"On sea and land alike do honor to this shrine of the Cypris of Philadelphus, who is Arsinoe. She it was, ruling over the Zephyrian shore, whom the admiral Callicrates was the first to consecrate. She, moreover, will grant a fair voyage, and when the storm rages will make smooth as oil the broad sea for them that entreat her."

At her death Ptolemy Philadelphus was consumed with grief and he entered upon an orgy of temple building in her honor. Most amazing of all these projects, according to Pliny², was the scheme of the architect Timochares "who had begun to vault over the temple of Arsinoe in Alexandra with lodestone in order that the iron statue, which it contained, might appear to be suspended in mid air. But his death and that of King Ptolemy, who had ordered the work to be done in honor of his sister, interrupted the project."

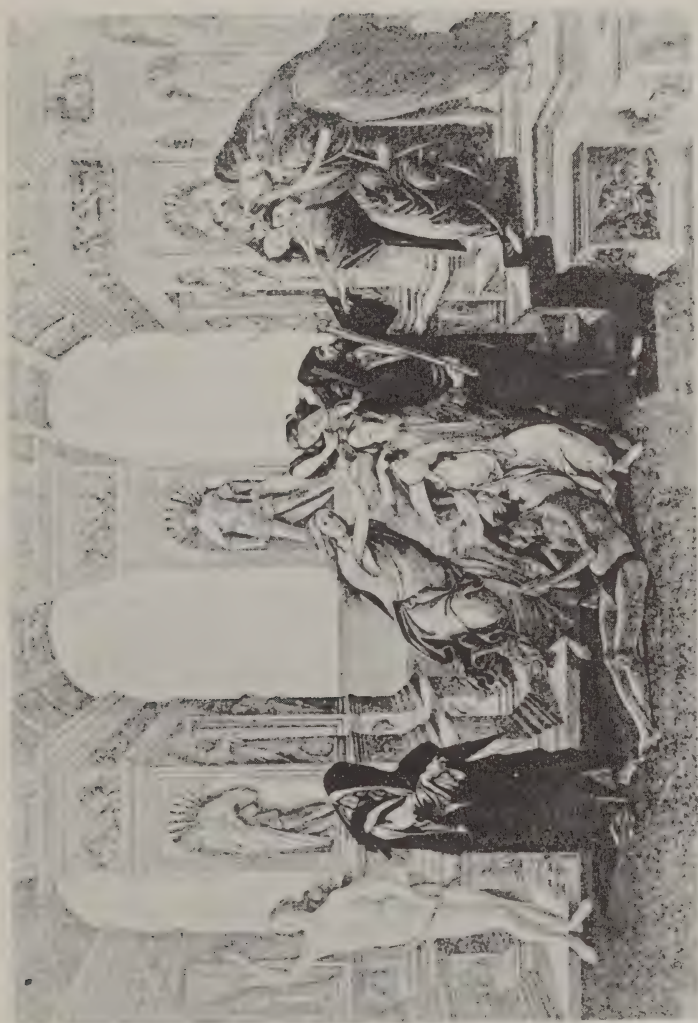
15. *The Banquet Begins.*

With the entrance of the king and queen the banquet soon gets under way. Lavish, indeed, it is as one might well imagine. Each guest is first presented with a silver cup containing a refreshing mixture of fruit juices, and a chaplet of gold is placed upon his head. These we are invited to keep as mementos of the occasion.

Thereupon the servants bring in individual platters of bronze which are heaped with loaves of bread and portions of fowls, chickens, ducks, ringdoves, and geese tastily broiled and served with garnishes of olives and other viands. When we have eaten our fill of this course, another platter of silver is brought in which contains a loaf and various meats, hares, young goats, pigeons, partridges, and that great delicacy of the Alexandrians, the flesh of bustards. This curious bird abounds in the desert spaces of Libya and great numbers are brought in to Alexandria. According to Athenaeus it

¹ *Athenaeus*, vii, 318.

² *Natural History*, xxxiv, 42.



The Rhodian scholars were impressed by the series of pictures hung between the columns in the banquet pavilion of Ptolemy Philadelphus. Perhaps one of these was the picture of CALUMNY by Apelles, which was reproduced as shown here by Botticelli from a description of the original given by Lucian.

is captured in a very strange manner. "This creature," he says, "is given to mimicry, particularly of anything which it sees a man doing. At any rate it does the same thing that it sees the hunters doing. So the hunters take a position in plain sight of the birds and smear their eyes with an unguent after preparing other unguents which cause eyes and eyelids to stick together; these they place at no great distance from themselves in small pans. The bustards, therefore, seeing the men take the unguent from the pans, do the same thing themselves and are quickly caught." The reader will not be blamed if he fails to believe this tale.

When we have partaken as much as we wish of this food we wash our hands and are served cups of wine. This wine, we understand, is of a very special vintage and is brought from the district near Antylla, a city not far from Alexandria.

There comes a lull in the feast. The area between the tables is cleared away, and a band of flute-girls, singers, and harpists come in to entertain us. My neighbor, who has lived for some time in Alexandria, points out a few of the celebrities in this group. The handsome young lady, the flute-girl on the right, is Mnesis and the equally comely one on the left is Potheine, both friends of the king and in great favor with all the courtiers, so much so that some of the finest houses have been named after them.

"You see also the girl who carries the king's cup and watches over his needs," said my neighbor. "Her name is Cleino and she also stands high in the affection of the king. If you wish to remember this occasion properly you should purchase in the shops one of her images and place it above your hearthstone. Probably you will also see the gorgeous Myrtion, who is our greatest actress and in the highest favor with all the Alexandrians."

Even as he speaks the group which has been entertaining us withdraws to either side. The curtains at the doorway are pushed aside, and there enters a very vivacious lady, richly adorned with jewels and golden ornaments. This is Myrtion, the king's favorite, who entertains us with the song of Adonis. A few of the lines will give some idea of the nature of the song¹:

¹ Theocritus, *Idylls*, xv.

“Lady of Golgoi, Idalion and Eryx’ lofty steep,
Thou that toystest with gold, Aphrodite, goddess, lo!
In this twelfth month of the year from Acheron’s ageless flow
The soft-footed Hours have brought Adonis from the deep.
Tardy goddesses they, the boon Hours, yea but blest
They come to us, ever bringing to mortals pleasure and ache.
Cypris, child of Dione, men say that thou didst make
Bernice, a mortal, immortal and fill with ambrosia her breast.
O thou, who by many a name art hailed in many a shrine,
This day Berenice’s daughter, the queen Arsinoe,
Decketh Adonis with all things lovely in honor of thee –
Arsinoe fair as Helen, as Helen of race divine.”

There is a storm of applause from the guests at this and the king is obviously pleased. Queen Arsinoe graciously bows and the actress is presented with a string of jewels in acknowledgment of her art.

16. *The End of the Banquet.*

The banquet is now resumed. Platters containing roasted pigs are brought in, stuffed with many delicacies, thrushes, ducks and warblers. There are also quantities of eggs, oysters, and scallops over which has been poured a rich pease puree.

While we are recovering from this feast girls enter with baskets filled with favors which are distributed to the guests. These are golden jars containing perfumery, a subject which had been of great interest to Berenice, the king’s mother, and was now to Arsinoe. Of the perfumes especially sought after by the Alexandrians we find orris root from Elis and Cyzicus, rose from Phaselis, saffron crocus from Cilician Soli and Rhodes, spikenard from Tarsus, drop-wort from Cyprus and Adramythium, majoram and quince from Cos, and henna from Egypt. The Alexandrians themselves specialized in a perfume called *metopion* made with the oil obtained from bitter almonds.

The feast continues and this time the servants enter with platters of roast kid, served with spoons of gold. Appetites have long since reached satiety, but we make attempts to eat, so delicious are the odors.

There is another interlude and we are entertained this time by dancers, clowns, and women jugglers. The latter are very good and they play with swords and blow fire from their mouths to the great astonishment of the guests.

The inevitable fish course follows, prawns for which the region is famous, broiled lobsters, squid, sea-eels, tunny and many other kinds too numerous to mention. Our jaded appetites are enticed with brazier-bread, "a soft and delicate compound dipped in sweet-wine" which makes us grow hungry again with its delicious flavor.

Then other favors are lavished upon us, and other entertainment amuses us, choral singing by a hundred men, and other dances.

But the hour grows late and finally the last course comes. The servants enter with baskets cunningly woven out of strips of ivory, and in these are sweet-meats and cakes of all descriptions, many of them cunningly moulded into shapes of Sileni, and Satyrs and other figures. The baskets, when they are empty, are presented to us as receptacles in which we may carry home the rich gifts that have been given to us during the evening.

At last we make our adieus. With heads swimming from the sumptuous banquet and our hands laden with our treasures, we emerge from the banquet hall into the cool air of night and seek our quarters in the palace. Never, we believe, since time began was there a place like the golden city of the Ptolemies, and never had mortals experienced such a day. Glorious, indeed, is the court of Ptolemy Philadelphus, for all its Bacchic revelry, with its wealth of ornaments, its marble palaces, its paintings and its sculpture, and most wonderful of all, its magnificent Museum whose roof we see afar shimmering in the starlight.

CHAPTER 2

BESIDE THE TOMB OF ALEXANDER THE GREAT

1. The Sepulchre of Alexander.

AS WE HAVE SAID before, the Sema is an enclosed area east of the Museum and connected with the palace gardens, which had been set aside for the sepulchers of the royal family. Therein now rested the remains of Alexander the Great and his most remarkable general, Ptolemy Soter, first king of the Alexandrian kingdom and the successor of the Pharaohs as ruler of the Egyptians.

We have no description from ancient writings of the tomb of Alexander, but its magnificence is attested by all accounts and it was guarded by the Alexandrians as perhaps their most precious possession because of the legends associated with it. For Aristander of Telmessus in Lycia, the favorite soothsayer of Alexander, who consulted him on all occasions, had foretold that the country in which the body of Alexander was buried would be the most prosperous in the world. Urged by this prophecy, or perhaps by other reasons of a political nature, Ptolemy Soter had been eager to secure the body of Alexander for burial in his newly founded city.

The accounts of the burial of Alexander differ widely from one another for legend has been busy with the career of this strange character. Thus Strabo in his *Geography*¹ says:

“Designated as a part of the palaces of the king is the Sema. This is an enclosure in which are the burial places of the kings and of Alexander. For Ptolemy, the son of Lagus, overmatched Perdiccas (one of Alexander’s generals, who had distinguished himself at Thebes in 335 B. C. and had taken an important part in the Indian campaign) by taking away the body as Perdiccas was bringing it down from Babylon and had turned aside toward Egypt to seize his share of the spoils and to appropriate that country for himself. More-

¹ xvii, 1, 8,

over, Perdicas was destroyed in a revolt of his soldiers, after he had been repulsed by Ptolemy and shut in on a desert island. Indeed, he perished, being stabbed by the spears of the soldiers who attacked him; but the kings who were with him, Arrhidaes and the children of Alexander, and Roxana, the wife of Alexander, departed for Macedonia. Ptolemy carried off the body of Alexander into Alexandria, where it now lies, not in the original sarcophagus, for this is made of glass, whereas the one in which he was first laid was made of gold. But the Ptolemy who was called both *Cocces* (Scarlet) and *Parcissactus* (Pretender), and who came over from Syria, plundered the sepulchre, but was immediately expelled so that his booty availed him nothing."

According to the account of Diodorus Siculus, an historian who lived in the time of Julius Caesar and wrote a *Bibliotheca historica* in forty books, Philip Arrhidaeus, the feeble minded son of Philip II of Macedonia who had been chosen by the Macedonian army at Babylon as the successor of Alexander, spent two years making elaborate preparations for the removal of Alexander's body. The council of generals at Babylon had directed that a magnificent catafalque should be constructed and that the body of the great leader be carried thus to the shrine of Jupiter Ammon, in the oasis of Siwa some 300 miles southwest of Alexandria, where Alexander had been deified ten years earlier.

The equipage was put in charge of Arrabaeus, a distinguished Macedonian noble and officer of Alexander, and was met in Syria by Ptolemy himself who led the procession to Pelusium at the most easterly mouth of the Nile. Thence it was transported on a royal barge to the city of Memphis. This royal procession excited the greatest interest and everything was done to impress the multitude with the magnitude of the event because of its political significance.

The funeral car itself was an ancient wonder and perhaps has never been excelled in the annals of coach-building. Designed by the architect Hieronymus, it is said to have required two years for its construction. Resting on four massive wheels, the car was eighteen feet long and twelve feet wide and was drawn by sixty-four mules, eight abreast. The upper part consisted of a platform with a lofty roof, supported by eighteen columns profusely decorated. The car was elaborately adorned with drapery and gold and jewels, and around

the upper edge of the roof there was a row of golden bells which rang continuously as the equipage moved along the road. In the center there was an elaborate throne and before it the coffin, around which were the weapons and the armor used by Alexander himself. Can we wonder at the sensation which so magnificent a sight created or at the prestige which thus came to the shrewd Ptolemy who directed it toward his own fortunes!

The body of the fallen king was left for a short time at Memphis, while a tomb fitting for such sacred remains was constructed in Alexandria. The splendor of the sarcophagus must have surpassed imagination, but assiduous search has not yet restored it to the modern world. However, at Sidon in 1886 there was found a sarcophagus made of alabaster which has been called the tomb of Alexander and which for beauty and adornment was worthy to contain the remains of the great leader. That it is the long-sought tomb is very doubtful, indeed, but that it dates from the time of Alexander is probable, and from it some hint as to the magnificence of the original can be obtained.

Along one side we find depicted scenes from a great battle, probably that of Granicus, a cavalry engagement in which the Macedonians overwhelmed the Persian army and opened the roads of the east to the conqueror. There we find charging war horses, archers in action, fallen soldiers, all mingled in desperate conflict. On the left we see the king charging the Persian cavalry, and on the right the general Parmenio, with some younger officer, perhaps Cleitus, in the middle. Mingled with these chief figures are the soldiers engaging and defeating the Persians. The other side of the sarcophagus shows Alexander hunting a lion in company with a Persian noble. The reliefs at the ends again depict adventures both in fighting and hunting of the great king. But there is a careful symmetry in the entire relief and figure is balanced against figure with an artistic skill not found in earlier works. The faces themselves show expression and "the composition is one in which the most careful planning and the most precise calculation are mingled with freedom of hand and expressiveness of detail".¹ Here is found, perhaps, the most

¹ *Encycl. Britannica*, vol. 12, 489.

authentic likeness of Alexander the Great, a contemporary portrait, which has set the style in much of the art that followed.

Of the appearance of the man who lies within the tomb we have several accounts. The best of these is from Plutarch who in his life of Alexander says:¹

“The outward appearance of Alexander is best represented by the statues of him which Lysippus made, and it was by this artist alone that Alexander himself thought it fit that he should be modelled. For those peculiarities which many of his successors and friends afterwards tried to imitate, namely, the poise of the neck, which was bent slightly to the left, and the melting glance of his eyes, this artist has accurately observed. Apelles, however, in painting him as a wielder of the thunder-bolt, did not reproduce his complexion, but made it too dark and swarthy. Whereas he was of a fair color, as they say, and his fairness passed into ruddiness on his breast particularly, and in his face. Moreover, that a very pleasant odor exhaled from his skin and that there was a fragrance about his mouth and all his flesh, so that his garments were filled with it, this we have read in the *Memoirs of Aristoxenus*.”

2. *The Tale of the Old Soldier.*

As we were about to leave the area of the Sema we encountered an aged man, who plucked our sleeve and asked us for an obol.

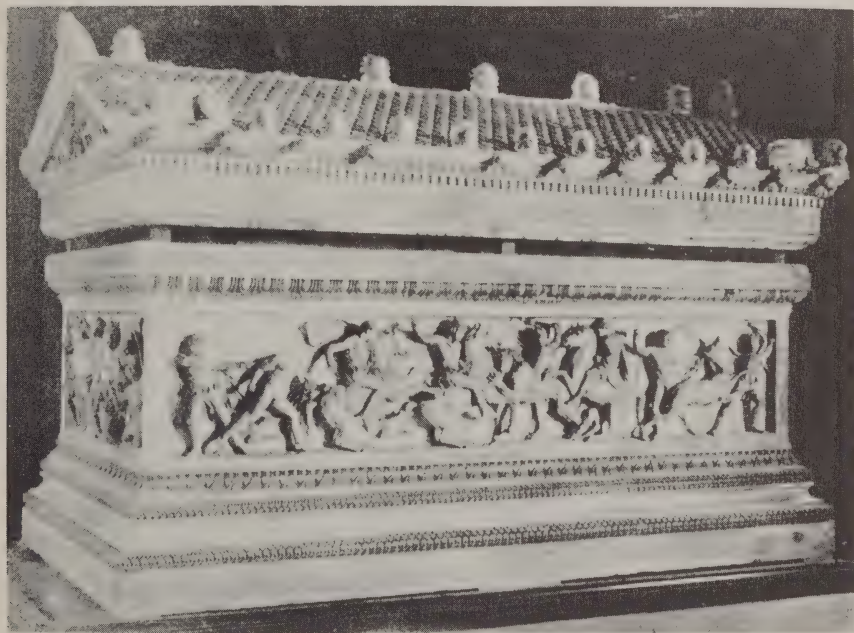
“Please, sirs, you have seen the end of the great king, but you have never seen his beginning as I did years ago in my native town of Pella in Macedonia. There in the fourth month of the first year of the 105th Olympiad (October, 356 B.C.) was born Alexander. I have heard my father say that on the night of his birth the temple of Artemis was burned and there were portents in the sky. Hegesias said that the goddess was too busy bringing Alexander into the world to watch over her own affairs. And there also was I born and through all the adventures of Alexander’s later life I was with him and I saw him on his last night and I accompanied him thither and here shall I remain until the great Zeus-Ammon gathers me also to my fathers.”

So we gave the old warrior a drachma and we sat down under a tamarisk tree in an alcove which the sun had warmed and listened to

¹Alexander, iv.

the strange tale of the adventures of Alexander III of Macedonia, called by all men the Great.

"I was brought up in the palace of the king in Pella," said the warrior, "and I played with Alexander as a boy, for he was fond of his friends and had a number of them. There was first Philotas, son of Parmenio, who later perished because of his boastful folly, and Harpalus and Nearchus, besides Erigyius and the hawk-nosed Ptolemy,



We stood before the tomb of Alexander the Great in the Area of the Sema in Alexandria and listened to the story of his adventures. The so-called SARCOPHAGUS OF ALEXANDER was found in Sidon, but the history of it is unknown.

who now lies here by his side in the Sema. Studious he was and full of wisdom from his tutors, but given to fits of brooding on the mysterious ways of the gods and how mortals may understand the meaning of signs and omens. This was the influence of Olympias, his mother, the snake woman, who made him believe that Philip was not his father, but that he had been conceived by the god Zeus-Ammon, who played so great a part in his later life.

3. The Taming of Bucephalus.

“You have doubtless many times heard the story of the horse Bucephalus. What a sight he was! A great black animal with a white mark on his forehead that resembled the head of an ox, from which he derived his name. Alexander, who was then about thirteen years of age, watched the men attempting to tame the animal, who was wild and intractable, and would allow no one to mount him. The king in disgust had ordered the horse to be led away when Alexander spoke up boldly and said: ‘What a horse they are losing, because, for lack of skill and courage they cannot manage him.’ At this there was raillery from those present, but as Alexander continued to protest, the king lost his patience and reproved his son with these words: ‘Dost thou find fault with thine elders in the belief that thou knowest more than they do or art better able to manage a horse?’ At which, Alexander, greatly piqued, replied that he could do better than those who had tried, and he laid a wager of the price of the horse that he could tame him. This was no small sum for Philip, it is said, had paid thirteen talents for the animal (about \$20,000).

“The wager having thus been laid, the daring youth ran to the horse’s head and turned him toward the sun, for he had seen that the animal was greatly disturbed by his own shadow. And after he had stroked the horse a little and calmed him, Alexander cast aside his mantle and lightly vaulted upon the back of the great Bucephalus. With a gentle, but firm hand, he guided the horse a ways and then gave him his head, for he was eager for a race, and urged him on with a thrust of foot and sharp command. Those watching, and especially Philip, the king, were consumed with anxiety for the safety of the rider, but Alexander made the turn at the end of the field and rode back toward them again full of pride in his achievement. All the men cheered with loud cries and the king was so moved that he wept and said to Alexander: ‘My son, seek thee out a kingdom equal to thyself; Macedonia has not room for thee.’

“And so Alexander kept the great horse with him and upon it he rode to his adventures. Once when Bucephalus was stolen by the theiving Uxian tribesmen in far-off Persia, so great was Alexander’s affection for his mount, that he issued a proclamation stating that

he would kill all the inhabitants, men, women, and children, unless the horse were immediately returned. So great was the fear of the barbarians, that the horse was brought back without further ado. At last near the river Hydaspes, which flows into the great Indus, Bucephalus died, worn out by age and the hardships of the vast journey which he had taken. Alexander founded a city there, called Bucephala to keep alive his memory in that distant land.

4. *Alexander and Aristotle.*

“When Philip thus saw that his son was so full of spirit he determined that Alexander should be instructed by the best teachers obtainable in order to prepare him for his destiny. The lad had already been taught by others, his tutor Lysimachus, a somewhat uncultured man, and his preceptor, Leonidas, who was called his foster-father and watched over his training with scrupulous care. Spartan in character, Leonidas trained the lad in fortitude and simple living. So irksome sometimes was this training that Alexander once complained: ‘Why, that man Leonidas would come and unlock my chests of bedding and clothing, to see that my mother had not hidden there something that I did not need, or that led to luxury and indulgence.’¹

“Pursuant to his wish, Philip searched the haunts of learning in Greece for the teacher of his son. Now I do not know whether it was the reputation of the man himself, or the fact that his father had been the friend and physician of Amyntas, King of Macedonia and Alexander’s grandfather, but the facts are that Aristotle was sent for by the king. Nor what the bargain was, I do not know, for Aristotle came from the city of Stageira, which Philip had pillaged sometime before. But when Aristotle became the tutor of the prince the city was restored and its citizens who had been exiled or sold into slavery were brought back again.

“The king then set up a place in the precinct of the nymphs near Mieza where pupil and tutor might converse together and for several years they lived in this close communion. I often heard them talking about the wonders of the world and the writing of the

¹ Plut. xxii.

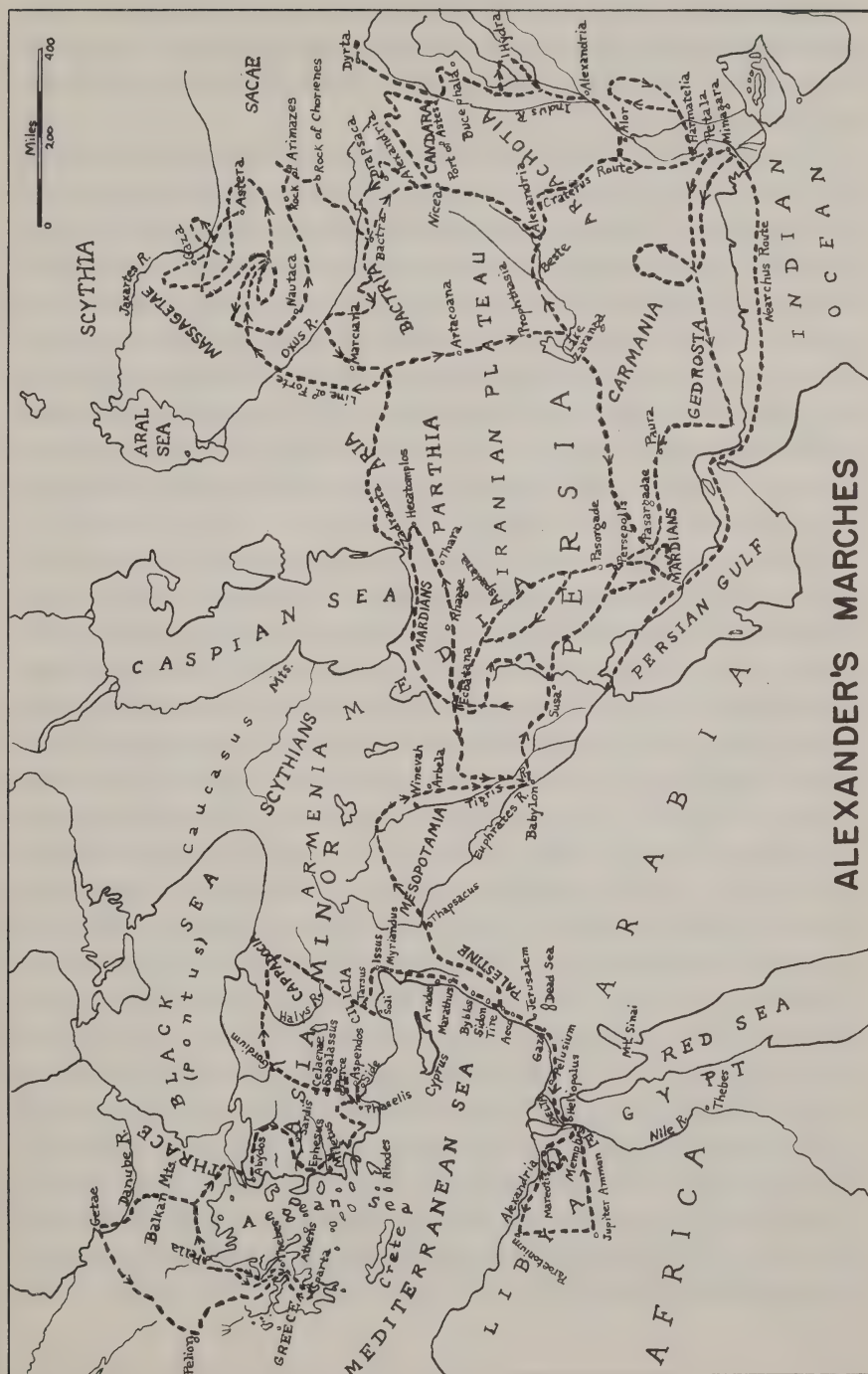
poets and ethical principles and the laws of government; and sometimes they wandered down darker paths of philosophy where I could not follow. But Alexander liked the best of all the tales of Homer, the suffering and the triumphs of the Hellenes on the fields of Troy, and the wanderings of Odysseus in his long journey back to Ithaca, his vengeance upon the suitors and his final meeting with the faithful Penelope. Most attentively he listened to the battles of the *Iliad*, the struggles of the heroes, the daring deeds of Hector and Achilles, For in them he found those things which fired his own ambition. By the hour he would study the heroic pages and plan the battles that he himself would fight. Since he thought that all of military art was in Homer he took with him Aristotle's edition of the *Iliad* and always kept it with his dagger beneath his pillow. In later days when the wealth of Darius had fallen to his sword, a very precious casket was brought to him. Thereupon he asked those about him what object was worthy to be contained within it. When all had given their answers, he said that he intended to place the *Iliad* inside as the only jewel worthy such a casket.

"Toward Aristotle he held the deepest affection and often said that he loved him more than his father; for the king had given him life but the philosopher had taught him a noble life. Aristotle himself, however, was interested in many matters, as well you know, the nature of animals and plants, the habits of the fish, and the character of other objects on the earth. It is said that Alexander gave him 800 talents for his studies and with this sum Aristotle put many collectors to work gathering specimens from all the corners of the earth. Charlatans or worse many of these must have been for 'from what Proteus, or Nereus, rising out of the deep, did he learn what fishes do, or how they go to bed, or pass the day?' But in later years a coolness came between them, as you have doubtless learned, for Alexander slew Callisthenes, the nephew of Aristotle, on suspicion of a plot against his life.

5. *Dreams of Empire.*

"Alexander, however, did not live long in the peaceful pursuits of learning, for when he had reached the age of sixteen years his

¹ Athenaeus, viii, 352; also, ix, 398.



father made an expedition against Byzantium and left him behind as regent in Macedonia. So well did he govern in his father's absence, quelling the rebellious Maedi and distinguishing himself against the Greeks, that the Macedonians spoke of him as their king and Philip as their general.

"Domestic affairs in the king's household were not moving smoothly at this time. Philip had married a new wife, and Olympias, the mother of Alexander, a woman of violent passions, was filled with fury. A coolness came between Alexander and his father which finally broke into open conflict when Alexander threw a cup at the head of the new queen's uncle, Attulus, and Philip set upon him with naked sword. Fortunately the king, both from anger and the wine which he had taken, tripped and fell upon the floor. Whereupon Alexander mocked his father saying: "Look now, men! Here is one who is preparing to cross from Europe into Asia; and he is upset in trying to cross from couch to couch."

"The outcome of this brawl was the departure of Olympias to Epirus and the withdrawal of Alexander to Illyria. But calmer councils saw the need for reconciliation and Alexander was prevailed upon to return to Macedonia, while Philip, to thwart the plots of Olympias, persuaded her brother, Alexander of Molossia, to accept Cleopatra, Alexander's sister, as his wife. A great festival was planned for this event, including a sun-rise procession of the statues of the twelve gods of Olympus. The scorned Olympias was wild with fury over this, as we may well believe. Her frenzy had no bounds when she heard also of the birth at that time of a new heir to the throne, a son named Caranus, borne by Philip's new queen Cleopatra. Olympias returned to Macedonia and found there ready for her plot a certain Pausanius, who had been basely dealt with by Attulus, the queen's uncle, and from whom he had received no redress on the part of Philip. The day of the festival arrived. The king had asked that his retinue of nobles precede him at some distance as he entered the great theater of Agae where the wedding procession was being held. This furnished the opportunity to Pausanius, who rushed upon the king and drove a short sword into his body, which killed him almost instantly. These things I saw with my own eyes and they are as I have told you."

The old soldier paused awhile and we could see that his mind's eye was running back again over the events of that momentous day, which was to transfer the destiny of the world from Philip to his impetuous and daring son. With a sigh the old man continued his story:

"Those who knew the nature of Alexander found in him a prince most generous and kind, provided they submitted wholly to his will. A hint of treachery he could not tolerate and neither ties of blood nor the bonds of life-long friendship could restrain his savage ire when plots were raised against him. In such events he took no half-way course, but struck with all the fury of the same imperious nature which had conquered Bucephalus. Thus it came about that when his mother had contrived to destroy the new Queen Cleopatra and her son, he also turned upon Attulus, the uncle, and all the other kinsfolk of the clan and removed them forever from his path.

"About this time the dreams of empire, which his father had held, came over the spirit of the youthful Alexander, then but twenty years of age, and he resolved to continue with the plans. He knew, however, that the states of Greece and all the wild tribes that bordered his Macedonian kingdom must have a lesson which should remain green in their memory while he was fighting on the plains of distant Persia. His counselors argued for conciliation, since Greece was in a tumult, and they feared lest the young king could not hold them in check now that Philip was dead. But Alexander knew the minds of men and how they appreciate boldness and a lofty spirit and the power of furious might. He determined, therefore, to give these lessons to his enemies. And thus he turned with fury upon the barbarians who had overrun his kingdom in the past and gave them such a taste of his power that it was not forgotten for many a year. We cannot tarry to describe these great campaigns, the unexpected marches, the novel methods of fighting invented by Alexander's genius, the terrible weight of his attacks, but everything was swept before him. As far as the river Ister (Danube) did he press and there he fought a battle with Syramus, the king of the Triballi, and routed his troupes with great loss. Thereupon, in order to give a dramatic appearance to his campaign Alexander crossed the great Ister by night in ships which had been sent to him from Byzantium through the

Euxine Sea and up the river, and he burned a city of the Getae. Then he sacrificed to Zeus, and to Hercules, and to Ister himself who had permitted him to cross the mighty stream. The fame of these great deeds went far ahead of the army and even the haughty Celts sent ambassadors to him. But when he asked what they feared the most in the world, they replied, to his chagrin, that they were afraid of only one thing, namely, that the sky would one day fall down upon them. Since his eyes were turned in another direction, however, Alexander treated them with friendship and mutual pledges were exchanged.

"The king had now been absent for five months from Macedonia and news was brought to him of other troubles. The tribes of Thrace were in revolt and Greece herself was seething with rumors that he had been conquered and was fleeing for his life. At once he marched over the hills into the affected provinces and by the strategy for which he became famous overcame with savage blows his enemies in spite of the fact that his own troops were far outnumbered.

"The last and most difficult problem now confronted him, the hostility of Greece, which was inflamed against him by natural antipathy to the Macedonian conquerors, by bribes from the Persian king, Darius III, who had ascended the throne in the seventh month of the fourth year of the 109th Olympiad (May, 336), and by the orator Demonsthenes, who produced in the Athenian forum a wounded man who swore that he had seen Alexander fall in battle. Now was the fateful moment when the chains of the conquerors could be broken, cried Demonsthenes. Thebens who were living in Athens and who heard these reports immediately returned home and persuaded their fellow citizens to declare their freedom from the Macedonian yoke.

"When the news of this revolt reached Alexander in distant Illyria he decided on the instant that the matter must be settled once and for all. By forced marches he crossed the rough mountain wildernesses and on the seventh day was encamped in northern Thessaly. The next morning he resumed his march and in six days more, right on the heels of the messengers who heralded his advance, he reached the vicinity of Thebes. Imagine the terror of his enemies when the dead appeared so miraculously before them at the head of his fearsome army! After some futile parleys in which a basis for peace was sought,

the Macedonians stormed the city and soon reduced it. Then Alexander made a terrible object lesson for the rest of Greece to ponder while he should be away in distant lands. All the buildings of this ancient place, except the Cadmeia, or citadel, the temples and holy places, and the home of Pindar, the poet, were destroyed. All the people who remained after the destruction of the city were sold into slavery, some thirty thousand of them, except that Alexander spared the priests and the descendants of the poet Pindar, for the lofty verses of this great poet he often praised. Athens he spared, and even those like Demosthenes who had spoken so bitterly against him, he left at liberty.

“Now, indeed, was Alexander ready for his great adventure. Far and wide had sped the fame of his deeds. None there was bold enough to raise a voice against him. For swift as the thunderbolt he fell upon his enemies, nor half-hearted were his measures of vengeance.

6. Alexander in Asia.

“And so it came about in the spring of the next year (334 B.C.) that the young king with his trained veterans came to the Hellespont, where Asia makes its nearest contact with the land of the Hellenes (about three-quarters of a mile). From there with one hundred and sixty ships he moved his force across the channel and stood at last in Asia. Foremost of his men, he leaped ashore and claimed the rule of Asia as ‘won by the spear’. Not a great force was it for so lofty an adventure in an alien land with the vast resources of the Persian king against him. For Alexander had not more than thirty-thousand foot soldiers and a cavalry of about five thousand. But the star of his destiny was high and the oracles were in his favor.

“Now that he was in the land where the Trojan war was fought he must visit Ilium and sacrifice to Athena and pour libations to the heroes of long ago. The gravestone of Achilles he anointed with oil and placed garlands upon it. Near it he ran a race with his companions, and declared that the hero was most fortunate to have had such a faithful friend in life as Patroclus, and such a one as Homer to tell his exploits after he was gone. He said that he would not care to see the lyre of Paris but that he ‘would gladly see the one of

Achilles, to which this hero used to sing the glorious deeds of brave men.'

"Reports now came that the generals of Darius had assembled a great force on the opposite bank of the river Granicus and were awaiting battle. In spite of the advice of his generals that the hazard was too large and that his men would be the objects of attack while in the disadvantageous position of crossing the river, Alexander was very impatient to begin his adventures. The affair to those of us who saw it looked like the maddest adventure possible, but our commander scanned the scene with a different eye. There faced us across the narrow stream a host of twenty-thousand Persian cavalry and the same number of Grecian mercenaries on foot, an array that was formidable enough when compared with our outnumbered force. For a moment both armies paused upon the banks of the river and not a sound was heard. Then blared the trumpets and at the head of thirteen troops of horsemen Alexander plunged into the stream. Wild were the struggles to gain a foothold on the muddy banks and savage the fight that followed. In the midst of all was Alexander, marked above other men by his bright armor and the great plumes which formed his helmet's crest. Hand to hand he fought with the Persian noblemen and nearly perished by a blow from Spithridates, who from behind lifted his hugh scimitar to cleve the king's head. But Clitus, son of Dropidas, rushed to his aid and by one blow cut off the poised arm, scimitar and all. This was, indeed, that same Clitus whom Alexander later slew in a fit of drunken anger.

"I cannot tell you all the story of this great battle," said the old man, "for that would take us much too long a time. But finally we prevailed and the vast army of the Persian king was in full rout unable with their darts to stop the thrusts of our long spears made of stout cornel wood.

"With this victory our work was just begun, however, for now we had the menace of the Persian ships to reckon with, a formidable force that could not be left to harry us in the rear. The remnants of the Persian army had been assembled under the old warrior, Memnon of Rhodes, who was also given command of the fleet. We could not take up an eastern march with this menace at our back.

"Alexander, therefore, turned south along the coast and one by

one the towns fell into his hands. First the old Lydian capital, Sardis, and then the cities of Aeolis and Ionia, and Ephesus without a blow, and Miletus after a short siege. But when we reached the strongly fortified city of Halicarnassus we found old Memnon there with the remains of the Persian army. Then were there blows a plenty both given and taken. We forced our way through the walls of the city, but the two citadels held out and there we camped until time should do our work for us. Winter finally came upon us with its blasts, whereupon Alexander sent many of his men home until spring should open up the ways again.

“Northward once more we made our way, leaving a small force to complete the siege of Halicarnassus, and after a number of engagements in which Alexander always had his way, we at last reached the city of Gordium. This was the place decided upon for the gathering of the army in the spring. In the temple of Zeus in the citadel of this ancient place there was a wagon, which according to the tale, had belonged to Gorgius, a poor farmer, many years ago. In this wagon his son Midas had one day reached a region where a group of Phrygians were discussing a prophecy by their oracle. This prophecy said that a wagon would sometime bring them a king who would put an end to the discords that had arisen among them. Whereupon Midas had been appointed their king and he had then dedicated the wagon to the god who had led to his good fortune. But there was still an unfulfilled prophecy about the wagon, which said that whoever could loosen the wagon from its yoke would gain the rule of Asia. Now the cord which joined these two together was made of cornel bark and so cleverly constructed that there was no end to be seen. After a vain attempt to solve the riddle Alexander in exasperation took his sword and at a blow severed the knot. At this a great cry went up, since in this manner he had fulfilled the conditions of the oracle.

“When the spring came at last and the mild winds blew again, Alexander was off to new adventures. Fortune had smiled upon him for Memnon had died of a fever during the siege of Mitylene and the plans of the Persians to use their fleet against him came to naught. Through Cappadocia we passed and then south toward Tarsus in Cilicia. The great pass through the mountains, called the Gates of Cilicia, was under guard by the enemy, but when Alexander advanced

in force the guards withdrew and Tarsus yielded without a struggle. But here misfortune fell upon the king for he was seized with a high fever and none of the physicians thought that he could live, except Philip in whom he had especial trust. While Philip was administering to him a letter came from Parmenio, warning Alexander that the physician was in the pay of Darius and would poison him with medicine. But Alexander, who had an eye for trust as well as treachery, believed in Philip. He, therefore, took the draught that had been prepared for him and as he put it to his mouth he handed the letter to Philip. That, indeed, was a scene to think about, these two men eye to eye, the king drinking and the other horrified at the calumny which had been directed against him. Philip beseeched Alexander to place his trust in him and Alexander showed his faith by drinking what had been prepared. Soon he began to mend and was able to turn his mind once more toward war.

7. The Battle of Issus, and After.

“Scouts were coming now in hot haste telling of the vast army which Darius had raised against us, some 600,000 men. These, they said, were waiting in the plains of Syria. Two roads led thither, the northern through the Gates of Amanus, the other through the Syrian Gates, eastward of Myriandrus (Alexandretta). Through the latter Alexander hastened with his small army, which only Zeus himself could make victorious over the vast minions of the Persian king.

“But Zeus was on our side that day for no sooner were we through the mountains than scouts came breathless with the news that Darius had left the open plains and was marching his army through the mountains onto the plain of Issus. Alexander, not believing that the Persian king would be guilty of such a folly, sent back a thirty-oared boat along the shore to verify this incredible report. But true it was, for there, indeed, were the vast hosts of the Persians struggling in the mountain passes, their cavalry useless in the narrow ravines, disorder everywhere. So Alexander, whose eye was always open to Fortune’s gifts, turned upon the Persians with all his fury and routed them in great confusion. One hundred and ten thousand men are said to have fallen on that day and Darius fled without his chariot or any of his baggage back toward his capital of Susa, which he must have wished by all the gods that he had never left. Among the prisoners

taken on that day were the wife of Darius and two unmarried daughters who set up lamentations when they beheld the king's chariot, for they thought that he was dead. But Alexander reassured them and treated them with the highest courtesy.

"After the battle of Issus, Alexander was indeed the conqueror, for none there was in all the land who could oppose his will. To



At the BATTLE OF ISSUS Alexander routed the Persian army and shattered the power of Darius in Asia. This famous mosaic found at Pompeii represents Alexander and Darius in this decisive engagement.

Damascus he sent Parmenio, who seized the property of the Persian nobles, their wives and children and the gold and other property which they had left behind them. With all this wealth in their hands, the army now became a pack of hunting dogs, hot on the trail. But Alexander turned not aside from his purpose, which was to take the coastal cities lest the Persian fleet have places for harborage.

"From Darius at this time there came messages asking that a truce be arranged and that the two kings enter into an alliance together. Alexander returned a haughty reply saying that he was now lord of Asia, and that for many wrongs done against him and his house he would seek the Persian ruler with the sword wherever he might find him.

“South we turned again and everywhere Alexander was treated as a conqueror. The kings of Cyprus put the island into his hands; but in Phoenicia Tyre resisted for seven months and Gaza, the principal city of Syria, for two more so that winter was again upon us before the coastal cities from Byzantium to Pelusium on the Nile had fallen to us.

8. *The Founding of Alexandria.*

“In time we reached the land of Egypt where the mild winds blew upon us from the desert and life was more pleasant in the winter time than in the summer. It was there in that ancient land that Alexander achieved two of the great dreams of his life, to found a populous city which should bear his name, and to be named among the gods.

“At Pelusium he found his fleet awaiting him, which had come down along the coast from Phoenicia. By Mazaces, the Persian viceroy of Egypt, he was well received and no hostile forces barred his way. Thence he proceeded with his troops toward Heliopolis and crossed the great river into Memphis, where he sacrificed to Apis and other gods, and held musical and athletic contests.

“From Memphis Alexander sailed down the Nile until he reached Canopus near the westernmost mouth of the great river, and thence he sailed around the Lake Mareotis, upon whose banks he decided to found the city which was to bear his name. I have heard that the site was not chosen in haste by him, but was revealed in a dream. In the night a vision appeared to him. A man of venerable aspect with hoary locks stood by his side and repeated these verses from Homer’s *Odyssey*¹:

‘An island is there in the dashing sea,
Before the shores of Egypt—Pharos named.’

“Alexander when he had awakened sought out the spot and saw, indeed, that here behind the island of Pharos was a natural harbor where ships could find a haven from the storms. At that time, the land between the island and the lake was given over to herdsmen, except for a small settlement called Rhacotis, which is the area now

¹ iv, 354.

near the Serapium. Here the early Kings of Egypt used to station guards, I hear, to keep away the traders, from whom they sought nothing and to repel the Greeks who were wont to take away with them more than they left behind.

“Alexander, as in a vision, saw a great city growing in this place, with marble palaces and temples to the gods, and commerce from all the seas. With the eagerness that characterized his every action, he summoned his builders and ordered them to formulate the plans for a great city. But it so happened that no chalk was at hand to mark the streets; at this Dinocrates¹, the architect, suggested that some of the barley used by the commissary might be employed instead. This seemed a good idea until birds from the river and the lake arrived in clouds and ate the grain as fast as it was thrown. At this Alexander was much disturbed lest it be a bad omen; but Aristander, the sooth-sayer, pondering the matter, said that the king should be of good cheer for the gods were showing that the new city would prosper and have an abundance of riches and would be a nursing mother for the men of every nation.

“With this solution Alexander was greatly pleased and he ordered the plans to go forward. Wise, indeed, they were, for they were formulated, it is said, by Dinocrates, who made wide streets and spacious parks, and broad areas for the temples as now you see them. Dinocrates, as you know, was he who later dreamed of carving Mount Athos into a gigantic statue of Alexander so that he might forever look out over the sea toward the distant plain of Troy. The gods willed otherwise, however, and Dinocrates died before the project could be carried out. Alexander, himself, took a lively interest in the plans of the new city which was to bear his name and he designated a special spot for a temple to the Egyptian Isis.

9. Alexander at the Shrine of Zeus-Ammon.

“While all this was going on Alexander was seized with a great desire to visit the shrine of Zeus-Ammon in the Libian desert [now the Oasis Siwa]. Was his father, indeed, this same god Ammon, as his mother, Olympias, had taught him to believe? So thither we went across

¹ Valerius Maximus, i, 4.

the desert sands, a terrible journey of seven days and seven nights. There is no road upon the trackless desert, nor are there trees or hills, or rocky places where one may gauge his way. All is sand blowing in the wind. As we went a desert storm came up and the sky was black with the rolling clouds of dust so that even the guides whom we had with us lost their way. But the gods, it seems, were watching over the king for ravens appeared from the heavens and pointed the way to us. Indeed, the son of Lagus, King Ptolemy, who lies here beside us, has said that two serpents came out of the sand and went before the army and that Alexander made the guides follow them, for he trusted in the divine portent. As for me, I saw only the ravens. Finally the water failed us and we were afraid that we should die of thirst in that horrid spot, when suddenly rains fell and the air cooled and the sand became firm again under foot.

“This terrible struggle, however, was finally at an end and we came in sight of palm trees rising from the desert’s floor. A fertile spot it was with a great spring of cold water bubbling from the sand, welcome, indeed, to our parched throats. Alexander alone was permitted to enter the temple of the god dressed in his ordinary clothes, but we, his followers, were compelled to change our garments. There Alexander heard what he had come to hear, that he was indeed the son of Zeus-Ammon as his mother had told him long ago. But some there are who say that he did not hear the priest aright, who meant to say ‘O pai’ don’ (O, my son), while Alexander understood instead ‘O pai Dios’ (O, son of Zeus).”

The old man paused a while, as if he would recall this strange adventure in the desert. Much that Alexander did in later years can be explained in terms of what happened on that small oasis in the temple of the oracle of Ammon. The legends that grew up around his name, the mysteries of his later worship, and the romance of Alexander which centered in the Ethiopian fable can be traced to this deification of the king. The Ptolemies, also, in a later time found use for this identification of a mortal with an immortal. Well may we wonder also, what other influence this had upon the world and the imagination of man. For in later times was not this single episode from the life of Alexander singled out by the Christian fathers for their thunders of denunciation?

At this time also there occurred another incident, too insignificant as far as Alexander was concerned to enter into the tale of the old soldier, but which was destined to play a considerable part in the future history of Alexandria. As Alexander moved westward along the coast before plunging into the desert wastes, envoys came from the city of Cyrene to him with costly gifts and pledges of allegiance. This incident fixed the western boundary of Alexander's empire and explains, perhaps, why there is no mingling of the histories of Alexandria and Carthage further west along the coast. Of the city of Cyrene, which was then one of the most famous of the Greek colonies, we shall hear more in the course of our history.

The old man resumed his story and once more we wandered with him on this strange adventure into the mysterious regions of the east.

"From the oasis of Ammon," he said, "we followed the restless king to Memphis where games and sacrifices were held and Alexander formed a court to settle the matters of his growing empire. To the south he had sent an expedition to inquire into the source of the great Nile. And from this report he was able to dispatch word to Aristotle that the floods came from the heavy summer rains in Ethiopia."

10. *The Defeat of Darius.*

"The time is now at hand for the next adventure, the journey into the heart of Asia, for spring was here at last. Alexander bade farewell to Egypt and we moved by easy marches back to Tyre, and thence, after a period of preparation, northward and eastward into the heart of the empire of Darius.

"At the city of Thapsacus we crossed the Euphrates river on a bridge of boats; and through dry and barren country in the heat of summer sun we marched over the broad plains of Mesopotamia to the river Tigris, whose name means *the Arrow*, since its current moves so rapidly. Alexander had heard that Darius was encamped upon the banks of the river to prevent a crossing, but when we arrived we saw no hostile forces there. This was fortunate, indeed, for the swift river gave us trouble enough in crossing.

"Scouts now came in haste to tell us that Darius with his army was near at hand, camping about 600 stadia (about 70 miles) from the city of Arbela, in an open plain, where all uneven ground had

been leveled off in order that chariots and horses could move unhindered. Vast indeed was the army which the Persian king had gathered, some say a million men – wild tribesmen from Media, Uxia, Armenia, Syria and other places, swarthy Arabs, horsemen from the steppes of Turkestan, and even Indians with their war elephants.

“At this time there happened a portent, which greatly disturbed our army, for the moon was covered with darkness. [This eclipse was on September 20, 331 B. C.] Alexander called upon Aristander, his soothsayer, to explain the portent. This, said the interpreter, was indeed an omen of evil, but not for the Macedonians, who worshiped Apollo, god of light, and not Astarte, goddess of the moon. She was the diety of their foes, and the eclipse meant then that the empire of the Persians would soon also be in darkness. Altars were then erected and sacrifices were offered to Helios, Selene, and Ge, dieties of the sun, moon, and the earth, which gave the men new courage.

“Eleven days after this event we came upon the hosts of the enemy. Vast, indeed, was the army of Darius, and terrifying enough by night with camp fires covering the plain as far as the eye could see. Parmenio came to the tent of Alexander and urged that he make the attack by night, so that our small force might have the advantage of the confusion of darkness. But Alexander replied: ‘I will not steal my victory.’ That night, in the face of this great peril, he slept more soundly than usual and was only aroused with difficulty the next morning by Parmenio, who ‘asked him how he could possibly sleep as if he were victorious, instead of being about to fight the greatest of all his battles.’ To which Alexander replied lightly: ‘What, pray? Do you not think that we are already victorious, now that we are relieved from wandering about in a vast and desolate country in pursuit of a Darius who avoids a battle?’

“All men know how this famous engagement was fought and won, – how Darius fled with a small retinue of his men, all that was left of the great army which he had gathered to stop the adventures of Alexander. Through the mountains of Armenia he fled toward Media, leaving behind him to the conqueror as the spoils of war the extensive empire which he had ruled. Alexander at last, and with good right, proclaimed himself the King of Asia.

“Flushed with victory, Alexander made sacrifices to the gods and

gave princely gifts to all who had helped him in the struggle. Upon the Greeks he bestowed their most sought-for gift, the boon of freedom. Their tyrannies were abolished and they were granted the right to make their own laws and live under them as best they could. To various cities he made special gifts, and to the people of Croton in Italy he sent some of the spoils in honor of their athlete Phayllus, who had helped the Greeks in the Median wars.

11. *Alexander in Babylon.*

"Southward now we march toward Babylon! What magic in that name to us, for Babylon was and always will be, a symbol of the mystery of the east. Huge walls, 50 cubits high [75 feet] and 360 stadia in their total circumference [more than 41 miles], wide enough for a four-horse chariot to turn about, formed great barriers to invading foes. Now the gates were open and priests and rulers came out to greet us, bearing gifts, and those who looked down upon us from the walls were not foemen, but citizens who had gathered to cheer the conquerors. Through the dark portals we marched and looked about us at the city of ancient dreams. Through it rushed the turbid waters of the Euphrates and upon the banks of this historic stream were the ancient palaces of former kings, one by Nebopollaser and another by Nebuchadnezzar. South of these had been the great temple of Bel, patron god of Babylon for as long as man could remember. Now only ruins marked the spot for Xerxes had destroyed it years before. On the north side of the river stood the royal park, with its gorgeous palaces, and near to these the famous hanging gardens, a wonder of the world.

"Of these great gardens, I must tell you, for even Alexandria here cannot show the equal of them. They were built, I hear, by Nebuchadnezzar, the Chaldaean, in honor of his wife Amyhia, a princess from Media. This princess, so the story goes, longed for the meadows of her mountains and the king, to satisfy this yearning, decided to build for her a mountain in the city of Babylon. Thus it came about that an area was set aside for the purpose and a series of terraces were constructed which rose tier on tier from the level of the city to the very top of the great wall. This astonishing mountain was supported by vast galleries made of solid masonry which rose little by little one above the other. The supporting walls

were twenty-two feet thick with passages ten feet wide between them. The roofs of the galleries were fashioned from great stones sixteen feet in length and four feet in thickness. Above these beams a covering of reeds was laid, bound together with great quantities of bitumen, and above this were two layers of cemented brick, and all was covered over with a sheath of lead lest the moisture from the gardens penetrate into the galleries. Upon this structure of bricks and stone the king piled dirt to a depth sufficient for the roots of the largest trees. This area was then laid out in flower gardens and planted with trees of all descriptions. Fountains played here and there supplied with water pumped from the river below, and in the galleries, which, since they projected one above the other, were open to the light, there were built many royal lodgings. From a distance this beautiful structure looked like a great theater, and doubtless Amythia as she wandered over the slopes of her artificial mountain no longer dreamed of the wooded glens of her native land. These things we saw and many more in the city of Babylon¹.

"In that ancient place, in the palace of the kings, Alexander tarried for awhile, giving rich gifts to the soldiers who had served him so well in his adventures. The citizens of the city he treated generously and true to his habit of honoring local gods, he gave orders that the temples should be restored, which had been destroyed by Xerxes, and especially that of Bel.

12. *The Death of Darius.*

"But all things, good and evil, must finally reach an end, and Alexander's restless spirit urged him on to other scenes. From Babylon we marched to Susa, the capital of Darius, where Philoxenus had been before us to seize the treasures there. Among these were 'five thousand talents' worth of purple from Hermione, which, although it had been stored there for a hundred and ninety years, still kept its colors fresh and lively. The reason for this, they say, is that honey was used in purple dyes, and white olive oil in the white dyes; these substances after the like space of time, are seen to have a brilliancy that is pure and lustrous."²

¹ Diodorus, ii, 10.

² Plutarch, xxxvi.

"We also found in these regions a chasm from which fire streamed forth continually as from a spring, and near at hand was a lake of naphtha. This magic fluid is so sensitive to fire that it ignites even before a flame touches it. Much amusement we had from watching it; for along the street which led to Alexander's quarters, quantities of this naphtha were sprinkled and when, after nightfall, torches were applied at one end, in the twinkling of an eye the fire raced up the street in a blaze beautiful to behold.

"From Susa Alexander marched into the land of the Uxians, who sent messengers to him saying that they barred the path to Persis, but would give him passage if he paid them the same tribute levied upon the Persians. He replied that if they gathered at the defiles which they believed they controlled, then, would he pay them toll. By another route he marched during the night against their villages, and when morning came exacted such a toll that all the tribes learned the nature of the man who had come to rule their land.

"Then began in earnest the implacable pursuit of King Darius, who was fleeing with his broken army further and further to the east. At Persiopolis we seized more treasure and Alexander burned the royal palace there, which, he said, was to be an act of vengeance of the Persians for their destruction of Athens years before. Others, however, tell a different story. For an evening of revelry was celebrated, where wine flowed freely and women sang and danced. Among these entertainers there was a certain Thais, mistress of King Ptolemy who sleeps here in the Sema beside Alexander. Thais came from Athens and when the revels were at their height she made a little speech in honor of the king in which she said that the great hardships of the journey from her native land were well repaid by the luxuries which they were then enjoying. But, she added, that her cup of pleasure would be filled to the very brim if Alexander would but burn to the ground the palace of the hated Xerxes, so that she might boast that the hand of woman avenged Hellas for the wrongs which had been done them by the Persians. A great shout went up at this, and the revelers marched forth with torches in their hands. Thais it was who applied the first fire to the palace.

"From Persiopolis we pressed on in relentless pursuit of the

fleeing Persians, northward toward the waters of the Caspian Sea. Spring had come again [in the year 330 B.C.] and Alexander hoped that year to end the long struggle which he had started. In Ecbatana Darius had collected another army, but as we approached he fled again northward. Thence, by forced marches, we passed through the Caspian Gates and out upon the plains of Parthia. During this time our march was hard indeed. The relentless sun poured down upon us and the earth was parched and barren. Water gave out at times and men, no longer able to endure the heat and toil, dropped in their tracks. But there was no delay, for Alexander was hard upon the heels of the Persian king.

"Messengers now came to our camp telling that Darius had been taken prisoner by his own men, so desperate had their lot become. The leaders of this movement were Bessus, and Barsaentes, and Nabarazanes, although Bessus had seized the command. Finally the desperate fugitives placed Darius in a carriage and with a small troop of horsemen set out with the greatest haste possible for the land of Bactra, over which Bessus held rule, and in whose mountain fastnesses the foe might well be held at bay. When Alexander heard this news he set out again with his weary men and by traveling all the long night came at dawn upon the Persian camp. Only sixty men were able to sustain this frantic journey, but that was force enough to terrify the enemy. They fled in great confusion, and Alexander and his men rode over quantities of gold and silver that had been thrown away, and wagons full of women and children, who had been abandoned. At last they came upon the wretched Darius, who lay in his chariot with his body full of javelins which Bessus and his men had thrust into it, when they were unable to persuade the king to mount a horse and escape with them. Thus the poor king died in that wild desert place, abandoned by his friends, a pitiable figure, who, from owning the richest kingdom in the earth, had come at last to this estate which even the lowest beggar would not envy.

"Alexander in a later time wreaked just vengeance against Bessus, the regicide. According to some stories, when Bessus finally came into his hands, Alexander bent two trees together and fastened the wretched man between them so that when they were

released his body was torn to pieces. Great, indeed, was the wrath of Alexander toward those who practiced treachery either against him or against their own rulers."

13. *The Black Deeds of Alexander.*

The old soldier paused and his eye seemed to rove back over those wild and barbaric scenes, which filled the life of Alexander, the man of destiny. We thought, perhaps, that he had finished his tale, for the sun was now approaching the western edge of the world and the shadows of afternoon were falling across the city. But the spell of stirring times was still upon him and he presently resumed his story.

"I cannot stop to tell you all that happened next," he said, "how Alexander marched with his men into Hyrcania, where his eyes saw for the first time the waters of the Caspian Sea, and thence into Parthia, and Aria, fighting all the while the fierce tribes of this wild land. Nor would it interest you to know how we marched over many a weary mile in the heat of the summer sun or when the cold winds of winter swept the desolate plains. For vast is that land, and vast the ambition of Alexander to subdue and conquer those who dwelt within it.

"More interesting than these adventures is the tale of Alexander himself, wandering now among strange people far from the shores of Hellas. Alexander was in very truth the king of Asia, and this power began to sway his moods and action. Living in the midst of oriental pomp, he gave up at times the simple dress of his Macedonian fatherland and wore, instead, the rich robes of the eastern kings.

"There were other matters also that I hate to dwell upon, I who was raised in the king's household in Pella, and sported with the king when he was but a boy. For dark they were and unworthy of a king. First he turned upon his friend Philotas, son of his father's general Parmenio, who because of age had been left behind to command the troops in Media. It seemed that Philotas was something of a braggart, and boasted of his own achievements, which he made out to exceed even those of Alexander. So great was his pride that Parmenio once warned him, saying, 'My son, be less of a

personage.' Whether these boasts of Philotas came merely from the pride of youth, or whether they presaged a darker plot against the person of the king, I do not know. But Alexander finally arrested Philotas, and accused him of treachery, and subjected him to torture, which made him confess to plans that, perhaps, he never had, and to implicate his father, Parmenio, in them. This sealed the doom of both the father and the son. Philotas was put to death, and a messenger was sent post-haste to Media to order also the execution of Parmenio, the old general who had served so many years and faithfully the house of Philip.

"At another time [in 328 B.C. at Samarkand in Sogdiana] Alexander in a drunken brawl turned upon his friend Clitus, the one who saved his life in the battle at the river Granicus, and slew him with a spear. For Clitus, piqued at an insult to the Macedonians, had rebuked Alexander for having turned his head toward eastern ways, a change so great in him that he had even disowned his father Philip in order to make himself the son of Ammon. In the heated argument that followed, Alexander, yielding himself to the frenzy of the moment, seized a spear and killed his friend. Great was his grief at this sad issue of a childish matter, and Alexander would then and there have slain himself had not the bodyguards seized his hands and carried him by force to his room.

"Then, also, there was the affair of Callisthenes, the son of a niece of Aristotle, a man of great learning, but too wise for his own good. This philosopher was a man of sturdy character, unawed by the arrogant manners of the king, and unwilling to submit to his assumptions that he was the son of the god Ammon. On one occasion at a banquet Callisthenes, who was an eloquent speaker, urged Alexander to recall the command which he had issued that men honor him by prostrating themselves in his presence. In particular, said Callisthenes, this odious command should not be extended to the Macedonians. This bold address greatly offended Alexander, and Callisthenes was from that time on a marked man. A short time after this incident a conspiracy was uncovered among the pages of the king to kill him, and Callisthenes, because he had been intimate with Hermolaus, the leader of the plot, was assumed to have been implicated in this rash affair. I greatly fear that the evidence for this accusation was very

scanty, for the life and actions of Callisthenes elevated him far above the level of such a plot. But Alexander was ready to believe the worst of this fearless sage and condemned him to death. Some say that Callisthenes was merely bound with fetters and carried with the army until he died, but others have told me that he was hanged. Deep though my affection is for Alexander, and high as my admiration mounts when I think of his mighty works, at these dark deeds I hang my head in shame.

14. *The Conquest of India.*

"I cannot tarry long enough to tell you all the things we did. But when spring came again [327 B.C.] there was an adventure which shows the daring spirit of Alexander. We had by then progressed far into the country of the range of mountains known as the Caucasus, though some there are who call them the Paropamisus [now known as the Hindu-Kush], where the snow fell deep upon the ridges, and wintry winds blew even in the summer time down the dark passes that one must travel. In this savage country there was a fortress perched upon a great hill called the rock of the Arimazes. Within it Oxyartes, greatest of the chieftains of Sogdia, had taken refuge with his family and his warriors. When Alexander summoned him to surrender he burst into laughter and replied that the king would need winged soldiers ever to reach him. This, indeed, seemed to be the case for cliffs on every side barred the way to the top. But Alexander, who deemed nothing impossible, offered rewards to those who would scale the rock, ten talents to the first man who reached the top, nine to the second man, and so on, to the tenth who would receive a single talent.¹ This great reward challenged the mountaineers whom he had with him and three hundred banded together to ascend the rock. One night through the snow and darkness they approached that part of the crag that was so precipitous that guards were not thought necessary to defend it. There by the use of iron tent pegs which they fixed between the crevices, and with stout ropes made of flax, they began the perilous ascent. Thirty of them fell to their death from the snowy ledges. So wild and

¹ Arrian says, the first prize was 12 talents, and the last 300 darics. One daric = 8.4 grams of gold.

precipitous was the country, and so covered with drifts of snow and sheathes of ice that even the bodies of those who fell could not be recovered. But when dawn came at last those who remained of this hardy band stood upon the summit of the rock, and waved flags to their comrades below to let them know that the great adventure had been achieved. Whereupon Alexander sent messengers to the sentries of his foe, telling them that his winged men had indeed scaled the battlements and were ready to fall upon them. This unexpected sight so terrified the Barbarians, that without even testing the strength of the little band of adventurers, they immediately surrendered.

"It was here that romance came to Alexander, for among the captives was Roxana, daughter of Oxyartes, said by everyone to be the most beautiful woman in Asia, excepting only the wife of Darius. No sooner did Alexander look upon her beauty than he fell deeply in love, and married her at once to the satisfaction of the Sogdian chieftain, who immediately joined forces with the king.

"The lure of mysterious India now came upon the restless spirit of Alexander and with a vast army, swollen by native tribesmen who had fallen under the spell of the conquering hero, we passed over the mountains into the land of the Indus. Heralds were sent ahead of the troops to announce the coming of this conquering host and to demand submission. But many were the hill tribes who fought against us, fierce and wily warriors, who never since time began had yielded to other men. Many of these tribes were conquered. Many adventures perilous and exciting befell us, as the invading tide of our arms swept into this great land.

"We came finally to the waters of the Indus river, which flows for many a long mile from the mountains to the sea. Thence we crossed on a bridge of boats and thus, in the spring of the next year [326 B.C.] found ourselves in the broad valley between the Indus and the Hydaspes rivers. It was here that Alexander fought his fourth great battle, which proved to all men, if proof were needed, that the king who led us was the greatest general in the world. Upon the further bank of the turbid Hydaspes was the powerful King Porus with his great army, fifty thousand infantry, three thousand cavalry, a thousand chariots, and, more terrifying than these, a herd of two hundred elephants. This force guarded all the crossings of the river.

“In order to deceive the enemy Alexander kept a din of clashing arms going in his camp. Then one night when scudding clouds and the roll of distant thunder forewarned a storm, Alexander with most of his forces marched up the river to a place where he had seen an island, heavily wooded and built for concealment. In the camp, he had left his general Craterus with instructions to keep the fires burning, and between the island and the camp he posted another force under the command of Meleager, Attalus, and Gorgias. The storm broke with torrential downpouring of rain, incessant flashes of lightning, and great claps of thunder; the wind blew a hurricane and the river soon became a raging torrent from the rain. Under cover of this violent tempest, Alexander and his men crossed the Hydaspes, which at one time broke its banks and forced them to wade breast high in the water.

“When morning came the troops stood upon the eastern bank of the mighty Hydaspes; the storm, which had formed a shield for our crossing, disappeared and the sun shone forth again. Then, indeed, was Porus much perplexed, for he was taken unawares and knew not which way to turn to face the greatest force. A detachment which was rushed forward to engage Alexander became mired in the wet clay along the river bank, and was completely routed. The Indian chieftain finally marshalled his forces into battle array, with the mass of elephants in the center of his line. These Alexander feared to attack, because his cavalry horses would not charge against them, and only infantry could be used in their assault. Alexander, with his practiced eye, saw that both flanks must be attacked and thrown back against the center, which might, by these maneuvers, be crowded together and rendered more vulnerable to his men. And here as always what Alexander saw was carried out, though hard the battle was and lasted for many hours. The forces that had been left across the river soon joined in the struggle and threw their new weight into the balance.

“In all of this King Porus showed himself to be a man of the highest courage. Of giant stature himself, he rode atop one of the largest of the elephants and was ever in the thickest of the fight, until, overcome from wounds he would have perished, had not Alexander ordered that he be tended. Because of his courage Alexander wished to treat Porus with consideration, and asked what favor he would like to re-

ceive. To which Porus replied: 'Treat me, O Alexander, in a kingly way.' Then Alexander said: 'For my own sake, O Porus, thus shall you be treated; but for your sake demand what is pleasing to yourself.' Porus replied that he had already made his one request. At this Alexander admired the courage of the king and not only restored his kingdom to him, but added to it other territory which he had conquered. After this Porus was his friend and ally.

"Still burning with desire to march deeper into this strange country of untold wealth and princely warriors, Alexander planned to press forward even to the mighty Ganges river. When the length of his ambition became apparent, however, the Macedonians, longing for their native country and seeing only hardships and bitterness ahead, revolted. Then, like Achilles, Alexander went into his tent and refused to see his friends, nor gave heed to the cries of his soldiers, who crowded round and besought him to come forth. However, when it became clear to him that the men would no longer follow in the course he wished to go, Alexander finally relented, and ordered boats to be constructed, so that part, at least, could float down the river to the sea, while the rest marched along the banks. Many skirmishes were yet before us, in one of which Alexander nearly lost his life. In his zeal to take a town of the Malli, the king leaped down from the wall with only three companions beside him. Before the army could burst the gates, Alexander had received a dangerous wound and nearly died. Zeus-Ammon must have taken him under his care that day for in the course of time he was well again.

15. *The March Through the Desert.*

"As it came about, after many hardships and much fighting and extensive explorations of that rich and fertile land, we reached at last the great ocean that most of us had never thought to see again. Then Alexander divided his men into three parts, one under Craterus to go north again to suppress a revolt in Arachosia and join him later somewhere in Carmania. Another was to go by sea, under the direction of Nearchus and meet him near the mouth of the Tigris river. Alexander was to lead the third by land following such courses as could be found along the coast. I shall not tell you all the tale of that dreadful

march, for even to this day my hair tingles when I think of it. For sixty days we traveled through that blighted land, burned by the desert sun, afflicted by disease, our tongues scorched and swollen from lack of water, and worst of all, our bodies thin and wasted for want of food. Few people, and those wretched beyond description, inhabit that desolate coast. Many among us died, and those who lived cursed the king for leading them through these desert wastes.

“But Zeus-Ammon still watched over his son, and in the course of time our broken army reached the town of Pura in western Gedrosia, where the earth once more produced the wants of man. There we rested from our hideous toils, and gained again the strength which the desert winds and the scorching heat had taken from us. So great was our relief that when we marched at last through the land of Carmania our passage became a Bacchic revel. The king himself sat upon a great dais under a canopy on a wagon drawn by eight horses and drank and feasted to the tune of flutes and pipes. Abundance of wine was provided for all the men and they followed as best they could with shouts and laughter, decked in garlands, and giving thanks to Dionysus.

“Soon welcome news came to us that Nearchus and his men, who had sailed along the treacherous coast, while we struggled in the desert, had found a safe haven after many perilous adventures. Soon also Crateras reported with his men, having succeeded in suppressing the revolt in Arachosia.

“For six long years the king had been busy in these distant lands¹ and much evil had taken place in his vast domain while he was gone. At Persia and at Susa there were many problems to be solved, and all who had misruled were punished with stern hand. For men, when under the scourge of greed, do evil things. One example of this we found in Pasargadae, where in the royal park there stood the tomb of Cyrus. Within the building there had been placed a golden coffin, and beside the coffin a couch with feet of gold, covered with rich rugs, and bearing ornaments set with precious stones. This royal sepulchre was guarded by two Magians, who dwelt in a small house beside the tomb. But when Alexander visited this place he found that robbers had been

¹ The pursuit of Darius started in the spring of 330 B.C.; Alexander returned to Susa in the spring of 324 B.C.

before him. He was greatly affected by the inscription on the tomb, which read: 'O man, whosoever thou art and whencesoever thou comest, for I know that thou wilt come, I am Cyrus and I won for the Persians their empire. Do not, therefore, begrudge me this little earth which covers my body.' Alexander at once ordered the restoration of the tomb, and sought out for punishment those who had committed this sacrilege.

"At Susa Alexander decided to celebrate his return from the perils of his journey by a great feast, which was, perhaps, one of the strangest children of his imagination. He had come to believe that Europe and Asia should be bound together by ties of blood. Thereupon he celebrated the great Marriage of Europe and Asia, where to all his companions, he gave wives and urged his Macedonian warriors to choose brides from these comely maidens of the orient. He, himself, although Roxana was still his wife, married also Barsine, the eldest daughter of Darius. The weddings were celebrated according to the customs of the Persians, and a great feast was given, whose magnificence can be imagined from the fact that nine thousand reclined at supper on that day. To each feaster a golden goblet was presented, and more amazing still, Alexander paid the debts of all his guests as a wedding gift. This, you may well believe, was the most popular thing that Alexander ever did.

16. *The Death of Hephaeston.*

"From Susa we went to Ecbatana in Media, and there occurred a tragic matter, which cast its shadow upon the future. For Hephaeston, he whom Alexander, mindful of Achilles, called his Patroclus and loved above all others, sickened suddenly and died. Great then was the grief of Alexander. For three days he neither tasted food nor saw his friends, but lay stricken on the ground; but when he had finally roused himself from this deep mourning, he cut his hair and ordered the manes and tails of all the horses and mules shorn; he stopped the sound of flutes and pipes for many days, and had a funeral pyre prepared in Babylon at the expense of ten thousand talents. Some say that he crucified Glaucus, the wretched physician of Hephaeston, and that in solace to his grief, he went forth to hunt down men who had

been against him. He sacrificed to Hephaeston as a hero, and built temples to him even on the island of Pharos here in Alexandria; he carried the body to the grave in his own chariot, and held funeral games in his honor, in which not less than three thousand athletes competed."

The old soldier paused again in his narrative and drew his cloak more closely around his shoulders, for the chill of evening was in the air and the sun, a ball of fire on the western edge of the world, was near its setting.

"Alas," he said at length, "my tale is nearly done. For now we started on the march to Babylon in the month of Peritius [February, 323], and as we neared the city certain Chaldaean seers came to Alexander and warned him that the oracle of Bel had advised him not to enter the city. Other omens also were unpropitious, but worst of all was the death of Hephaeston. Did not the passing of Patroclus precede but a short time the death of the hero Achilles?"

"While all these matters weighed heavily upon Alexander, since he doubtless saw the doom that was drawing near, his restless spirit turned to many matters. He gave orders that a pyramid, greater than any of those in Egypt should be constructed over the grave of Philip in Macedonia; he made plans for the building of six huge temples to Zeus, Athene, and Apollo, and he pushed with unremitting zeal the construction of the great tomb for Hephaeston just outside the walls of Babylon. Stirred by the adventures of Nearchus, who had finally completed his long journey up the dangerous coast of Arabia, he planned himself to set out upon explorations in those waters to find the route to Egypt through the ocean. A great basin was being dug to hold a fleet of a thousand ships, and preparations were pushed for the construction of the necessary vessels.

17. *The End of the Adventure.*

"By day Alexander held court seated upon a great golden throne in the park, but by night he drank and reveled with his companions, sometimes until dawn streaked the eastern sky. Dangerous moods came upon him, when all about him feared his wrath. These in turn were followed by melancholy, while he brooded over the dark future ahead.

“The fate which the gods had decreed for him arrived at last. On the seventeenth day of Daisios [June 2, 323] Alexander feasted with his friends. He ate and drank heavily, but could not empty the cup of Hercules [which held six quarts] when the health of his friend Proteas was proposed. As the party was breaking up he was invited by Medius, the Thessalian, to come with a few friends to be his guests awhile. Pledges were given there and received until the break of day. Then a fever came upon him and he was ferried over the river to the palace in the royal gardens, where he proposed to rest awhile until he should recover from these torturing excesses. The next day he felt better and dined awhile with Medius. On the following morning he was ill again, but received word from Nearchus that finally the fleet was ready and preparations had been completed to sail immediately on the new adventure. His fever increased. He called Roxana, his wife, to his side and asked her to have his body secretly cast into the waters of the river, so that when he had disappeared his men might believe that the gods had taken him. By the ninth day of his illness the rumor spread that the king was dead, and his generals came to the palace in a body to learn the news. They passed silently beside the bed upon which lay the great body of Alexander, too weakened by fever to move. On the following day he fell into delirium, but in the afternoon his mind cleared a little and Perdikkas, leaning over him, asked to whom the throne should be left. To Perdikkas Alexander then gave the imperial seal ring, and with his dying breath replied the single word ‘Kratisto’ [‘To the strongest’]. And thus, just as the evening shadows fell across his bed, the spirit of Alexander the Great joined the shades that live below.” [June 13, 323.]

The old man stopped at last. Rousing himself as from a dream, he turned his head toward the western sky where the sun, a ball of red, was just touching the edge of the great ocean. We gently helped him to his feet, for he was stiff from long sitting, and together we slowly passed through the gates of the Sema.

CHAPTER 3

A NIGHT WITH THE POETS

1. *We Gather in the Hall of the Museum.*

LET US HURRY TO THE MUSEUM! There are rumors abroad in the court of the literati that a new poet is about to try his wings and such spectacles are often amusing. It may prove especially so tonight for there is current chatter that we shall have excitement. Some say that the wings of the new poet are made of wax and that the hot breath of Callimachus, king of the Muses, will try to melt them. Let us hasten to see the fun!

Thus it comes about that we, who visited Alexandria so many years ago, arrive on an evening in the year 250 B.C. at the great hall of the Museum. King Ptolemy Philadelphus still sits upon the throne of the golden city and his beneficent hand is always open when the needs of the Museum are presented to him. It is possible that he may attend the meeting tonight, for he keeps a lively eye upon his brood of poets. But we have heard that the torments of the gout are upon him and that he goes not abroad as much as formerly.

The meeting tonight is for the elect, and there are many of these present. The center of learning has shifted toward the golden city, and the scholars of all lands are welcomed within the precincts of this Temple of the Muses. The great hall is already filling with the scholars and their friends, and we hasten to find a seat where we may observe those who enter. It is a pleasant sight, indeed, for the robes of many of the visitors are gay and colorful. Their faces glow with anticipation under the flickering light from the lamps swinging from the rafters of the lofty ceiling.

Some notables are already present and another enters. This we can tell by the stir of the people and the whispers that run from neighbor to neighbor. "Who may this one be?" we ask the old man who sits next to us.

“What! You must ask who is Theocritus?” he replies in some astonishment. “The greatest poet of them all, singer of sweet pastoral poetry! Another day you must get him to recite some of his lyrics to you.”

2. *Theocritus, Father of Pastoral Poetry.*

At this information we eagerly fix our eyes upon the famous poet, for we are in the presence of the Father of Pastoral Poetry, the ancestor, as it were, of that long succession of writers who in every age turned their eyes to the green vistas of the meadows and their ears to the soft murmurs of the wind in the forest trees. This elderly man, now well past sixty, with his dreamy eyes and his long silvery hair, was the first of all the poets to invoke the sylvan Muse, to strum his lyre to the sound of the pipes of Pan, and to turn away from the adventures of the gods and martial heroes toward the softer lyrics of the shepherds in their fields.

Of the life of Theocritus little is known except what may be inferred from his poetry itself. He was associated not only with the court of Ptolemy Philadelphus, but lived also for a while in Syracuse, during the reign of King Hiero, and studied in the school of the poet Philetas in the city of Cos situated on the island of the same name. It is conjectured that he was born in Cos, which at that time was a center of culture and learning. Situated not far from the southwestern corner of Asia Minor, at the mouth of the Gulf of Helicarnassus, the island was much valued by the Ptolemies as a naval outpost from which a watchful eye could be kept upon the troubled waters of the Aegean. Under the patronage of these wealthy kings, the capital city developed into a kind of auxiliary branch of the Alexandrian Museum, and some of the Ptolomaic princes were sent there to acquire their education. Among the famous men produced by this learned center were Hippocrates, the father of medicine, and Apelles, the most famous painter of antiquity.

The poems of Theocritus that have been preserved to us consist of a set of thirty idylls. These may be classified into *bucolics*, which treat of country life, *mimes*, whose scenes are in the town or city, *epics*, which include hymns and memorial poems, and *lyrics*. A num-

ber of epigrams are also known, although some of these are of doubtful authenticity.

Although Theocritus thus employed different modes in his poetical contributions, his principal influence upon the world has been exerted through his creation of the pastoral lyric. He was succeeded in the Alexandrian school by Moschus, who probably lived around 150 B.C. and by Bion of uncertain date, whose *Lament for Adonis* compares favorably with the beautiful creation of a later day written by Shelley as an elegy on the death of Keats. Between Theocritus and the poets of the romantic school of our own times, Vergil is probably the most conspicuous example of the influence of this new lyric fashion; the *Eclogues* of this famous Roman reflect clearly the deep influence of the earlier Alexandrian.

In spite of the dominance of the pastoral theme in his poetry Theocritus produced other lyrics of an essentially different character. An example of this may be seen in the conversation between *Gorgo* and *Praxinoe*, two young matrons of Alexandria, who have been invited to attend a party given by Queen Arsinoe. Some very modern complaints will be observed in the following verses:

xv. GORGO AND PRAXINOE

Gorgo (putting her head in at the door).

Praxinoe in?

Praxinoe. Oh, there you are at last,
Dear *Gorgo*! Yes, I'm in. I'm quite surprised
To see you here at all. Quick, *Eunoë*, fetch
A chair for my friend, and put a cushion on it.

Gorgo. Nay, leave it as it is.

Praxinoe. Well, sit you down.

Gorgo. Oh dear, how faint I feel! I hardly got
To your house alive out of the dreadful crush
Of chariots and of people. Soldiers' boots
And cloaks here, there, and everywhere — I thought
The way would never end. Your house, my dear,
Is much too far away from ours.

Praxinoe. My silly husband's fault! He came and took
At world's end here a beast's lair, not a house,—
Merely to keep us apart, the jealous wretch!
And all for spite, as usual.

Gorgo. Hush, my dear!
 Don't rail at Dinon so before the child.
 Look, woman, how he eyes you! Never mind,
 Zopyrion dear, sweet boy, it's not papa
 That mother talks of.

Praxinoe. By our Lady Goddess,
 The baby understands us!

Gorgo. Pretty papa!

Praxinoe. Well, that papa of his the other day —
 We always say 'the other day' you know —
 Went to the shop to buy me soda and rouge,
 And brought me salt instead, the hulking oaf!

Gorgo. My spendthrift husband is another such.
 Five 'fleeces' (Heaven save the mark!) he bought,
 For five-and-thirty drachmas yesterday —
 Dogskins, old wallet-shreds, mere trash and trouble.
 But come, put on your mantle and your gown,
 And let's be off to Ptolemy's palace-hall
 To see the 'Adonis'. It is said the queen
 Is planning something splendid.

Praxinoe. 'All is rich
 In rich men's houses.'

Gorgo. Think what a tale you'll have
 For those that have not seen the show. Now come,
 It's time to move.

While these thoughts are running through our minds, we again address our neighbor. "Since you seem to be a native here, and we but strangers in Alexandria, tell us more about Theocritus. Where, by the gods, did he learn to write such lyrics?"

"You must ask that of the Muses, especially Euterpe, who presides over the department of lyric poetry," replies the old man. "Some say that Theocritus owes both the form and the fancy of his songs to his teacher. This noble poet, Philetas, was brought over from Cos, you know, by Ptolemy Soter to be the tutor for his son, our present king. He died many years ago, about the time when Philadelphus came to the throne, killed, I hear, by too rich a diet of Magarian dialectics. You know yourself, perhaps, the absurd logical subtleties of the school founded by Euclides of Megara, one of those who followed Socrates. At any rate, you can even now read the epitaph on his tombstone: 'Stranger, I am Philetas. The deceiving word caused my death, and the studies of riddles too late at night.' I knew the old

scholar well, and in spite of his peculiarities, he was a man of real genius."

"Was he the one they all call the thin man?"

"Thin, indeed," replied our neighbor. "That is a poor word for it. The poets of his time used to say that he had to wear lead in his shoes to keep from being blown away. For all of that, however, Philetas had a rich style. His muse was Erato, you know, who instructs men in the art of amorous poetry. He wrote most feelingly in praise of his mistress Bittis, she of the nimble feet. His countrymen of Cos have erected a bronze statue of him under the great plane-tree there, and I for one believe that the honor is well deserved."

3. *Zenodotus, the Textual Critic.*

At this moment an elderly man enters the room and takes the seat next to Theocritus, who greets him with the affectionate regard of an old friend. There is another nudging of elbows, and we realize that the newcomer is to be listed among the notables. Something familiar about his face sticks in our memory, however, and we realize that we must have met him on our first visit to Alexandria. While we are trying to recall the occasion, our neighbor turns to us and says: "That is Zenodotus, who has been the librarian of the Museum for these many years. He also was a student of Philetas, and is without question one of the best known figures in Alexandria. I hear that he celebrated his seventy-fifth birthday the other day, but the vigor of his step gives promise that he may live to be a hundred."

We admit that we met him nearly thirty years ago, and are pleased to note how well he keeps his age.

"Tell us whether he ever completed his edition of Homer," we ask our neighbor. "When we were here before, he was working on it and hoped to finish the project in another year or two."

"That was indeed the sensation of the Museum some twenty-five years ago," the old man replied. "Never before in the history of the world had there been so fine a work, and it has set the pace for the younger scholars in the Museum. There have been readings of both the *Iliad* and the *Odyssey*, and many lines had been added by those who thought that they could improve upon the words of the divine

Homer. But Zenodotus would have none of that. Homer must be as Homer wrote it. All the manuscripts that could be obtained were brought together and the readings compared with one another. Some of the lines Zenodotus rejected, marking them in the margin with an obelus. In one of these, for example, he argued that Aphrodite, the goddess, would never carry a seat for Helen, the mortal, and thus the line was deleted as spurious; another he excluded because a goddess *endeavored* to find an object, when her omniscient power would make such trial unnecessary. Other lines Zenodotus altered to suit the sense, and even himself added verses in order to complete the meaning. He is quite a poet on his own account, you know."

These remarks interest us greatly, for here, then, was the Father of Textual Criticism, an art that has flourished among the scholars of all times and places. To many of the uninformed this task of editing an author's works may seem to be a thankless one, full of grubbing toil and poorly paid when compared with the satisfaction that comes to what we are pleased to call the creative artist. Strange to say, the case is otherwise for the creation of an authoritative recension of some great writer is a task as thrilling as any other excursion into the realms of science. Those who appreciate the long trail upward of the human race, the struggle to preserve what other men have thought and done, the ceaseless fight to keep the remorseless tooth of time from destroying the best of other days, those, indeed, who understand such things will turn an eye as respectful as our own upon that old sage in the Museum in Alexandria.

Zenodotus was the first of a succession of men who sought to preserve the texts of the classical writers of ancient Greece. He had what might be called the gift of scholarship. He was succeeded in his work by Aristophanes of Byzantium (c. 257-180 B.C.), who also during the latter part of his life held the position of librarian in Alexandria. Zenodotus had divided the *Iliad* and the *Odyssey* into twenty-four books each and had invented some of the methods of textual criticism. But Aristophanes went much further. He reduced accentuation and punctuation to a definite system. He also edited the *Theogony* of Hesiod and the works of the lyric poets, Alcaeus, Anacreon, and Pindar. Following the leadership of his master, he divided these into

books and otherwise systematized the editions. As one might well believe, these literary labors led naturally to lexicography and Aristophanes compiled an important dictionary of unusual words.

The chain of scholarship was not broken by the death of Aristophanes for he passed on the torch to his famous pupil, Aristarchus of Samothrace, who succeeded him in the administration of the library. With this great scholar ancient philology reached its culmination. His writings are said to have filled no less than eight hundred volumes, of which a part were notes for lectures, but many more were completed treatises on subjects relating to literature. Aristarchus was born about 217 B.C. and lived in Alexandria during the reign of Ptolemy Philometor (181-145 B.C.). But when Ptolemy Euergetes II, whose evil ways we shall have occasion later to describe, came to the throne Aristarchus feared that his life was in danger, although he had been employed as a tutor in the royal family and had been the teacher of the new king in his youth. Together with many other scholars in the Museum he was forced to flee from Alexandria and took refuge in Cyprus, where he died soon after.

The contributions of Aristarchus to the permanent record of the world are many. Still unsatisfied with the text of Homer, he produced new editions of both the *Iliad* and the *Odyssey*, which became the established recensions for many years thereafter. He worked also in the field of grammar. Although Aristotle had named and defined various parts of speech, the first complete and systematic summary of syntactical units is credited to Aristarchus. He recognized definitely eight parts, his enumeration being the noun, verb, participle, pronoun, article, adverb, preposition, and conjunction. It will be observed that these differ from the modern definition in two respects, the participle being replaced by the adjective, and the article by the interjection. Aristarchus included the adjective in the category of the noun.

4. *The Gathering of the Scholars.*

While we are reflecting upon the debt which the world still owes to the lives and labors of these old scholars, there is another stir in the audience as two men enter talking animatedly with one another. One of these is very striking in appearance and he walks with more of the

bearing of a prince than a man of letters. We turn again to our neighbor for enlightenment.

"You are, indeed, strangers to Alexandria if you do not know those two. One of them is Conon, the astronomer, who is in high favor with the king because of his great knowledge of the stars. Some say that he can even tell the destiny of men in the configurations of the planets, an art that has within recent years been introduced by the Chaldeans. I hear that he is much interested in the eclipses of the sun and has been making a collection of them from the records of the Egyptians. The gods alone know what he will do with them."

"And who is his distinguished companion?" we ask.

"He is not a native of Alexandria, but spends much time here in the Museum," replies our neighbor. "He is a native of Syracuse, and is in high favor with Hiero, the king. Some say that he is a relative of that enlightened sovereign, but whether that is so, or not, there is no question that he has much rank in the court. I know not why he comes tonight, nor Conon for that matter either, since both are deeply engrossed in their scientific studies. His name is Archimedes."

Then in truth we marvel at the glorious Museum of Alexandria, for where in all the world had there ever assembled at one time in one place so many men of such supreme genius? What university thereafter could call the roll of its faculty and have responses at one time from as many celebrities as were under that single roof that night? Since we are soon to dine with Archimedes, and since his thoughts are doubtless slightly foreign to the main purposes of our meeting, we shall postpone making his acquaintance until another time.

Our neighbor now nudges us and indicates a young man who has just entered the door.

"Keep your eye on him," the old man says, "for the world will some day hear great things from him. His name is Eratosthenes. I learn from others that he shows unusual promise. He comes to us from Cyrene and I understand that he is to sail in a day or two for Athens. His teachers say that they have never had a pupil with such varied and universal interest. His mind whips out like a lash and he has already mastered much of the learning here. Callimachus, who is also a native of Cyrene, has taken a great interest in his career and be-

lieves that Athens is now the place for him. Although his mind runs to science, I hear that he has literary talent and has already produced some very creditable poetry. May the gods preserve him on his journey!"

This prophecy of our neighbor was amply fulfilled in later days and we shall meet Eratosthenes again in the course of our chronicle. He it was who first had a vision of the vast size of the earth, and, with his brilliant insight into the relationship of things, developed a method for measuring its size.

5. *The Rider of the Blind Pegasus.*

"There are others whom you should know," said our helpful neighbor, indicating two patriarchs who had taken seats near the front of the room. "The eldest is Lycophron, who as you see by his snow white hair is very old; the other is Alexander Aetolus, who has just arrived I hear from Pella in Macedonia for a short visit with his old friends. Both were summoned to Alexandria some thirty-five years ago at the accession of King Ptolemy Philadelphus to classify the dramas in the library. Lycophron was entrusted with the work of the comic poets and Alexander with the tragic and satyric dramas. Alexander left some twenty-six years ago to live in Pella, but Lycophron has grown old among us."

"Haven't we heard that Lycophron is something of a poet?" we ask. "But his meaning, we understand, is a bit difficult to grasp."

"Difficult!" replied our neighbor. "Even the gods can't understand him. For all of that his verses have a melody that others envy. His fame rests upon his poem called *Alexandra* although he also wrote many tragedies. Its theme is simple, but the meaning is beyond us all. It seems that a slave was appointed by Priam, the king of Troy, to watch over Cassandra, his daughter. You will remember that she was the one on whom Apollo conferred the gift of prophecy, although he doomed her also never to be believed. The slave in the poem is reporting to the king what he has heard Cassandra say. But the words, though moulded into a melody of sweet sound, are far from clear to us. In fact, I would say that we don't know what they mean at all. In it we recognize the figurative picture of Alexander the Great, and the

prophecy perhaps refers to his conquest of Asia. Some, however, believe that the struggle between Macedonia and the Romans is meant. But when we ask of Lycophron his meaning, he only smiles and talks of other things."

From which it will be seen that even in that distant time there were poets who rode upon a blind Pegasus, poets who sought to attain fame by pleasing words without the bother of using sense as well. One may greatly fear that in some distant era, when others dig from the rubble of our own ruins the tattered fragments of more modern works, they also may be sadly puzzled to find meaning that should have been in the words, but which was unfortunately omitted.

"I wonder where the entertainer of the evening is?" says our neighbor, glancing toward the door. "I hope that the poor young man has not lost his nerve in the face of what may now be in store for him. Ah, here he is at last."

Into the room comes a young man of pleasing appearance, but obviously nervous. He holds a bulky papyrus roll under his arm, and quickly takes his seat where he begins to wipe his face although the evening is far from warm. He cannot be more than twenty years of age, and we feel pity for him when we glance around at the stern faces of that august audience. For this was Apollonius, later to be known as Apollonius of Rhodes. He, it seems, has had the temerity, or perhaps we should say the rashness, to bring a newly written manuscript into this court of the literati for their judgment. Apollonius, we understand, was born in Alexandria and has been a student in the Museum, working especially under the direction of Callimachus. He is a young man of high ambition and great spirit. Reports have come to us that some differences of opinion exist between him and the master. There is obviously an element of drama in the present situation.

6. *Callimachus, Dictator of Letters.*

A stir goes through the assembly, but it is clear that the entertainment is not yet ready to begin. Faces are turned expectantly toward the door and neighbor whispers to neighbor: "What detains the master?"

We have not long to wait for through the door now comes a man of

mature years, powerful of build, imperious of mien, who enters the room with the step of one who wears authority. We recognize him as the matured image of the young man who first guided us through the halls of the Museum and dined with us as we talked with Euclid so many years ago. This is Callimachus, dictator of letters, king of the Muses, and the all-powerful president of the Museum.

Callimachus was born in Cyrene about the year 310 B.C. and claimed that he was a descendant of Battus who, according to legend, had founded the city some three centuries earlier. Nurtured in the cultural atmosphere of Cyrene, Callimachus developed a love of learning and in time moved on to Athens to complete his studies. There he became a pupil of Praxiphanes, the peripatetic philosopher, who as an author of treatises on poetry, history, and other literary modes, must have been the source of great inspiration to the young man.

While in Athens Callimachus became acquainted with Aratus, also a pupil of Praxiphanes. Although one may doubt that Aratus was ever a resident of Alexandria, his poetry is always classified with the Alexandrians and he certainly belongs to the scientific tradition of the Museum. Aratus appears to have gone to the Macedonian court at Pella about 276 B.C., which was then a center of scholarly work under the patronage of the enlightened king, Antigonus Gonatas. While there he composed his famous poem, *Phaenomena*, which describes the constellations, and discusses the signs in nature which indicate the expected state of the weather. This interesting poem, based upon the work of Eudoxus of Cnidus, one of the most famous geometers and astronomers of Greece and the predecessor of Euclid, exerted a profound influence not only upon the astronomers who followed him, but upon later poets. The most conspicuous of these were Vergil and Lucretius.

After his training in Athens Callimachus returned to Egypt and became a teacher in Eleusis, the suburb of Alexandria with which we are already acquainted. Shortly thereafter he was introduced to the court of Ptolemy Philadelphus and from that time on until his death Callimachus was one of the most notable members of the Museum.

The work of Callimachus was remarkable both for its magnitude

and its variety. He is said to have written some eight hundred volumes, one work alone being a biographical list in one hundred and twenty books of the literary celebrities of the past. This monumental contribution gave not only the names of the authors, but the biographies of the most celebrated, and in the case of the Attic drama, the dates when the plays were produced. This list was divided into eight categories: (1) Dramatists, (2) Epic and other poets, (3) Legislators, (4) Philosophers, (5) Historians, (6) Orators, (7) Rhetoricians, (8) Miscellaneous writers. Athenaeus has given us some indication of the nature of the entries in this work in the following note¹:

“There is even a book by Chaerephon recorded by Callimachus in his *Table of Miscellany*; he writes as follows: ‘Writers on dinners: Chaerephon; dedicated to Pod.’ And then he subjoins the beginning of it, ‘Since you have often bidden me’ (and adds the size) ‘in three hundred and seventy-five lines.’ That Pod was a parasite has been explained before.”

The reputation of Callimachus rested mainly upon his poetry, a sizable sample of which fortunately has been preserved for us. Callimachus preferred the short poem to the long epic. His style was much more influenced by the Homeric hymn than by the lengthy episodes of the *Iliad* and the *Odyssey*. We have the words of six of these Callimachian hymns, written in majestic hexameters, which must have furnished a solemn and exalted background for the public occasions at which they were recited. The first hymn is dedicated to Zeus and its style may be inferred from the closing verses:

“Hail! greatly hail! most high son of Cronus, giver of good things, giver of safety. Thy works who could sing? There hath not been, there shall not be, who shall sing the works of Zeus. Hail! Father, hail again! and grant us goodness and prosperity. Without goodness wealth cannot bless men, nor goodness without prosperity. Give us goodness and weal.”

Hymns are also addressed to Apollo, and to Delos, where there was a famous shrine of the god. “Wind-swept and stern is she,” sings the poet of this holy island, “set in the sea, and wave-beaten as she is, [Delos] is a fitter haunt for gulls than a course for horses. The

¹ vi, 244.

sea, rolling greatly round her, casts off upon her much spindrift from the Icarian water." Other hymns are dedicated to Artemis, "whose study is the bow and the shooting of hares and the spacious dance and sport upon the mountains" and to Demeter, the "lady of much bounty, and of many measures of corn." The final hymn is written in honor of the annual custom of bathing the image of the goddess Pallas Athena, and is entitled the *Bath of Pallas*. "Now comes Athena in very deed," says the poet. "O maidens whose task it is, receive ye the goddess with pious greeting and with prayer, and with the voice of thanksgiving."

Fragments of certain longer poems also remain. The first of these, called the *Aitia*, or *The Crime*, relates the story of Linus, one version of which runs as follows: When Psamathe, daughter of Crotopus, king of Argos, had a child by the god Apollo, she became afraid of the anger of the king and exposed the babe in the fields. There Lindus, as the child was named, was found by the sheep-dogs of the king and slain. Thereupon, in great anger, Apollo sent a female monster by the name of Poinē to punish the people of Argos and this vengeful lady stole the children from their mothers until she was slain by Coroeus. Following this the Argives were beset by another plague until Coroeus went to Delphi to atone for his crime, and as a result of the instructions of the oracle, built a new shrine to Apollo.

Similarly drawn from mythology is the poem of *Hecale* about which Crinagoras, who flourished during the reign of the Emperor Augustus, made the following comment when presenting a copy to the emperor's nephew, M. Claudius Marcellus: "This is the chiselled work of Callimachus; for on it, indeed, he shook out every reef of the Muses. It sings the cabin of the hospitable Hecale and the toils that Marathon imposed on Theseus. His young strength of hand may it be thine to win, Marcellus, and equal praise of glorious life!" We do not have enough of the original poem to construct its plot, but the following excerpt from the life of *Theseus* by Plutarch gives the story of Hecale:

"Theseus, wishing to be actively employed, and at the same time to win the favor of the people, went out against the Marathonian bull, which was causing no small annoyance to the inhabitants of the Tetrapolis, and he overcame the bull and drove it through the city to ex-

hibit it, after which he sacrificed it to Apollo Delphinus. Hecale and the legend of her reception and entertainment [of the hero] seem to be not quite without some portion of truth. For the demes round about used to meet and hold a Hecalesian festival in honor of Zeus Hecalus, whom they called by the pet name of Hecaline, because when she entertained Theseus, who at the time was quite young, she addressed him as an old woman would and greeted him with that sort of pet names. When Theseus was setting out to the conquest she vowed in his behalf to offer a sacrifice to Zeus if he came back safe. She died, however, before his return, and received the above mentioned honors, in return for her hospitality, by order of Theseus, as Philochorus relates."

Of different character from the poems which we have described was another written under the title of the *Iambics*, to indicate the poetical meter employed. The poem apparently tells several short stories, one of which is the tale of the old philosopher Thales. Legend relates that a cup was once left by Bathycles, a native of Arcadia, to be given to the wisest man. But when Thales was chosen for this honor, he passed it on to another whom he deemed wiser than himself, and this man to another, and so on, until finally the cup was returned once more to Thales.

A few epigrams and fragments, which include some lines from the celebrated poem on the *Hair of Berenice*, known through a translation by Catullus, to which we shall make more extended reference in a later chapter, complete our knowledge of the work of this prolific and interesting figure.

7. *The Dictator Speaks.*

Let us return once more to the hall of the Museum, where the audience is now awaiting expectantly the opening of the meeting. Calimachus finally rises in all the majesty of his learning. Fixing his eyes upon Apollonius, who squirms uneasily in his seat, he begins his discourse.

The dictator of the Museum first mentions the glories of the past, the noble works by which Homer has enriched the knowledge of the world. But these epics, he goes on to say, should be left in their solitary grandeur. The lofty steepes of epic poetry should not be es-

sayed by modern youth, who will find more profit in courting the muses in the lower valleys of Mount Olympus. There they can ramble in the haunts of Euterpe, who presides over lyric poetry, or with her sister Polyhymnia, who teaches one the art of sacred hymns, or with Terpsichore, who sings the choral songs. Let Calliope, the muse of epic poetry, keep to the high ridges of the mountain where the winds are chill and the pathway covered with sharp rocks. Take as models the noble hymns of Pindar, who sang exultingly: "Mine be it to invent new strains, mine the skill to hold my course in the chariot of the Muses, and may courage go with me, and power of ample grasp." Look also upon "sweet-smiling" Sappho, and golden-tongued Anacreon, who even found the piping of the grasshopper in the meadows not too lowly a theme for his Muse.

"Look you at Theocritus here, and note the tenor of his verse," says Callimachus. "One does not weary of the eternal length of the epic roll when Theocritus sings. Nor is he unworthy of emulation, for Homer cannot show more melody than he. Note you these verses wherein poor Simaetha invokes the gods for love of her faithless lover, Thestylis:

'Lo, as I melt this wax, and Heaven implore,
So may love melt the Myndian to the core;
And as love's goddess whirls this brazen wheel,
So whirl she *him* one day about my door!

Turn, magic wheel, and draw my Love to me.

'The chaff I'll burn now; Artemis, thy spell
Can shake the very adamant of Hell.—
Hark, Thestylis, the dogs howl through the city!
The Queen is at the cross-roads — beat the bell.

Turn, magic wheel, and draw my Love to me.

'Lo, now the winds and seas asleep are laid,
But my heart's ache sleeps not and is not stayed,
Ah me, for I am all aflame for him
That left me not a wife, nor yet a maid!

Turn, magic wheel, and draw my Love to me.'

"Or if this song is not to your liking then there are other modes as full of fancy. Look you, for example, at my friend Aratus. He searches the sky at night and tells us the story of the stars. He ob-

serves the simple aspects of nature and warns us of the coming storm. Well can one emulate him in such passages as these:

‘Sure signs of storm are geese hastening with many a cackle to their food, the nine-generation crow cawing at night, the jackdaw chattering late, the chaffinch piping in the dawn, waterfowl all fleeing inward from the sea, the wren or the robin retreating into hollow clefts, and tribes of jackdaws returning late to roost from dry feeding-grounds. When the furious tempest is imminent, the tawny bees go not far afield to cull wax, but wheel hard by their honey and their stores, nor do cranes on high in long lines wing their steady onward course, but wheel and double in their flight.’

“But perhaps the great vehicle of all is the noble hymn, in which we may sing praises to the gods who watch over our destinies. This is the one most pleasing to my own muse for it carries the human spirit to its highest raptures, the honor of the immortal gods. I offer you tonight a new hymn, which I have dedicated to Apollo, who presides among other things over the arts of poetry and song.”

Thereupon the old scholar began to read the lofty hexameters of his hymn, which appeared to stir very deeply those who listened with such rapt attention. It is useless to attempt to catch in English words the melody of the Greek hexameter, for that language seems peculiarly adapted to the longer meter, whereas English dactyls appear heavy and stilted, as one may observe in those attempts which have been made to translate Homer into hexameters. We can catch the spirit, though not the rhythm, of the hymn from the following excerpts:

“Now the laurel branch of Apollo trembles! how trembles all the shrine! Away, away, he that is sinful! Now surely Phoebus knocketh at the door with his beautiful foot. Sees’t thou not? The Delian palm nods pleasantly of a sudden and the swan in the air sings sweetly. Of yourselves now ye bolts be pushed back, pushed back of yourselves, ye bars! The god is no longer far away. And ye, young man, prepare ye for song and for the dance.

“Not unto everyone doth Apollo appear, but unto him that is good. Whoso hath seen Apollo, he is great; whoso hath not seen him, he is of low estate. We shall see thee, O Archer, and we shall never be lowly. Let not the youths keep silent lyre or noiseless step, when Apollo visits his shrine, if they think to accomplish marriage and to

cut the locks of age, and if the wall is to stand upon its foundations...

"Golden is the tunic of Apollo and golden his mantle, his lyre and his Lyctian bow, and his quiver; golden too are his sandals; for rich in gold is Apollo, rich also in possessions; by Pytho mightst thou guess. And ever beautiful is he and ever young; never on the girl cheeks of Apollo hath come so much as the down of manhood. His locks distill fragrant oils upon the ground; not oil of fat do the locks of Apollo distill, but very Healing of all. And in whatever city those dewes fall upon the ground, in that city all things are free from harm.

"None is so abundant in skill as Apollo. To him belongs the archer, to him the minstrell; for unto Apollo is given in keeping alike archery and song. His are the lots of the diviner and his the seers; and from Phoebus do leeches know the deferring of death...

"Hië, Hië, Phaeëon, we hear—since this refrain did the Delphian folk first invent, when for the first time thou didst display the archery of thy golden bow. As thou wert going down to Pytho, there met thee a beast unearthly, a dread snake. And him thou didst slay, shooting swift arrows one upon the other; and the folk cried: 'Hië, Hië, Phaeëon, shoot an arrow!' A helper from the first thy mother bare thee, and ever since that is thy praise.

"Spake Envy privately into the ear of Apollo: 'I admire not the poet who singeth not things for number as the sea.' Apollo spurned Envy with his foot and spake thus: 'Great is the stream of the [Euphrates] river, but much filth of earth and much refuse it carries on its waters. And not every kind of water do her votaries carry to Demeter, but of the trickling stream that springs from a holy fountain, pure and undefiled, the very crown of waters.'

Callimachus stops and there is great applause for the master has undoubtedly produced for them one of his most masterful poems. There are many present who see through the allegory of the last lines, for Callimachus has openly avowed himself a foe of "the great book," and of the poets "that singeth things for number as the sea," that is to say, the writer of long epic poems. He has committed himself and his reputation before the world of letters to the shorter verse. Since his young pupil, Apollonius, is known to have taken ex-

ception to this mandate of the master, there is keen anticipation in the audience as they await the next speaker.

8. *The Epic of Apollonius.*

The young man, who had been showing increasing uneasiness as Callimachus warmed to his theme, now faces the crucial test of his fortunes. He hears as from a great distance the words which summon him to the floor and slowly rising, Apollonius begins to open his bulky roll. No small book, indeed, is this!

"I tell a different story from my honored master, Callimachus," the youthful poet begins, glancing uneasily at the faces of the intent audience before him. "For I have written here a longer poem and in it I tell the story of the Argonauts."

Neighbor glances at neighbor at this bold announcement. "What a rash young man," their eyes say to one another. Apollonius then commences the reading of his martial hexameters:

"Beginning with thee, O Phoebus, I will recount the famous deeds of men of old, who at the behest of King Pelias, down through the mouth of Pontus and between the Cyanean rocks, sped well-benched Argo in quest of the golden fleece.

"Such was the oracle that Pelias heard, that a hateful doom awaited him—to be slain at the prompting of the man whom he should see coming forth from the people with but one sandal. And no long time after, in accordance with that true report, Jason crossed the stream of wintry Anaurus on foot, and saved one sandal from the mire, but the other he left in the depths held back by the flood. And straightway he came to Pelias to share the banquet which the king was offering to his father Poseidon and the rest of the gods, though he paid no honor to Pelasgian Hera. Quickly the king saw him and pondered, and devised for him the toil of a troublous voyage, in order that on the sea or among strangers he might lose his home-return.

"The ship, as former bards relate,..."

During the recital of these verses it was quite evident from the suffused face of Callimachus that the choler of the old scholar was rapidly mounting. Majestically he rises from his seat and poor Apollonius stops short in the midst of his recitation.

"Cease!" cries Callimachus. "What I have heard by rumor is then

true indeed. You dishonor the sacred name of Pindar, who has told this story far more simply than you can ever do in these heavy verses which you have dared to read to us. Do you believe that you are worthy to touch the hem of Homer's garment? All my instruction, then, is wasted since never can you reach the sacred heights of poetry through such long journeys. You think you ride upon the wings of Pegasus, but you really wander through the gutters with the ibis. I'll hear no more of this."

And with haughty mien the dictator of the Museum, gathering his robes about him, walks in dead silence through the hall and out into the night air. Then, indeed, there rises such a clamor as had never been heard within those sacred halls, some blaming the king of the literati for his arrogance and others the rashness of Apollonius, who had dared march so boldly against the canons of Alexandrian poetry. Poor Apollonius stands at first in complete confusion, clutching his great roll against his body, and then he too leaves the hall of the Museum.

9. *The Feud of the Ibis.*

And so began one of the most memorable and bitter feuds in the entire history of literary men, for this struggle between the great book and the little book has been remembered for twenty-two centuries. Poor Apollonius, bitter with humiliation and vowing vengeance upon the proud dictator of the Museum, fled to Rhodes, where he proposed to remain the rest of his life. With him he carried his cherished manuscript, hoping that the Rhodian scholars would prove more charitable than the bigotted poets of the Alexandrian Museum.

After him Callimachus hurled the most savage satire that ingenuity has ever contrived. He took his cue from the comparison which he had made of Apollonius to the ibis, and under this title the poem is remembered by the world. The original is lost, but the nature of its bitter invective can be learned from the copy, or perhaps a partial translation of it, given to us by Ovid, who used it against his own enemies when he was sent in exile from Rome.

To be called an ibis in Alexandria was scathing insult as one may infer from the following description given by Strabo: "Every crossing

in Alexandria is full of them; and though they are useful in one way, they are not useful in another. The bird is useful because it picks up every kind of vermin and the refuse of the butchers' shops and fish markets, but not useful because it eats everything, is unclean, and can only with difficulty be kept away from things that are unclean and do not admit of any defilement." But the poem outdoes itself in bitterness and gall. Even Swift in his harshest moments might envy some of the lines of this shocking poem.

"And thou too, *Ibis*, why doest thou hesitate to assume the mournful fillets? The altar, as thou seest, is now standing ready for thy doom. The procession is prepared for thee; be there no delay in the fulfillment of my vows of ill omen for thee. Victim accursed, extend thy throat for my knives. May the earth deny thee its produce, the streams its waters; may the wind, and may the air deny thee their breezes. May the sun be no longer bright for thee, nor the moon shining; may all the stars fade from before thy eyes. Let neither the god of fire, nor air afford thee their use; let neither the land nor the sea afford thee a passage. An exile and in need, mayst thou wander; mayst thou visit the thresholds of others; and mayst thou beg a little morsel with tremulous lips. Let neither thy body nor thy weakened mind be free from complaining pain; and may the night prove more tormenting to thee than the day, and the day than the night.

"Mayst thou ever be wretched; and mayst thou be pitied by none. Let both man and woman rejoice in thy misfortunes. Let hatred be added to thy tears, and when thou art enduring a multitude of woes, mayst thou be deemed worthy of still more. May too, which seldom happens, the hateful appearance of thy sorrow be deprived of the usual interest. May the occasion of death not be wanting to thee, but may its opportunities be denied thee; may life, forced upon thee, never meet with the death that is longed for. May thy breath, only after a prolonged struggle, forsake thy agonized limbs; and may it torment thee first by being long drawnout."

Whether these words of Ovid are a faithful reproduction of the original *Ibis* of Callimachus we do not know, but that it was sufficiently bitter is quite evident from the flight of Apollonius and the fact that thenceforth he called himself the Rhodian.

10. *The Vindication of the Argonautica.*

But the end of the drama is almost as interesting as its beginning. For it seems that Apollonius was accepted by the literary men of Rhodes and when the *Argonautica* was finally issued it was greeted with flattering praise. Exceptional honors were heaped upon the poet and he was rewarded by having the franchise of Rhodes granted to him.

However, as time rolled along, Apollonius began to yearn for another sight of his native city; perhaps a stronger motive may be found in his desire to show himself to his old enemies again as a man highly esteemed by the literary elite of Rhodes. Whatever the motive, Apollonius finally returned to the golden city. His old enemy Callimachus was dead and the newer generation no longer felt restrained in its poetic tastes. Apollonius once more read his poem in the hall of the Museum and the *Argonautica* was accepted with the praise which it deserved. Some say that its author was made the chief librarian upon the death of Eratosthenes. And when he finally died, his body was laid to rest beside that of Callimachus.

In some respects the *Argonautica* is one of the finest products of the literary school of Alexandria. It is inferior to Homer's epics which preceded it, and to Vergil's *Aeneid* which followed it. But it contains a number of passages of rare beauty and the story of the love between Medea and Jason is one of the notable contributions to the world of Hellenistic literature. This epistle exerted a great influence upon Vergil in his portrayal of the poignant romance of Queen Dido.

The story itself tells the adventures of the Argonauts who are sent out in the ship Argo under the command of Jason to seek the golden fleece in Cholchis on the shores of the Euxine sea. After many adventures the heroes reach the land of Cholchis and request the fleece from King Aetes. This ruler finally accedes to their request, but imposes upon Jason two tasks. One of these is to yoke two flame-breathing bulls to a plow and sow a field with dragons' teeth. The second is to slay the giants who spring up from this fearsome seed. But Medea, daughter of the king, falls in love with Jason and she gives him drugs to tame the bulls. She also instructs him in the meth-

od by which his second task may be accomplished. The poem describes this in the following graphic manner:

“As when, in the murk of night, after a heavy storm of snow hath fallen on the earth, the winds do scatter the wintry clouds once more, and all the heavenly signs at once are seen shining through the gloom; even so these warriors shone as they grew up above the earth. But Jason remembered the counsel of crafty Medea, and caught up from the plain a great round rock, a fearful quoit for Ares the War-god; four strong men could not have stirred it ever so little from the ground. This did he take in his hand, and threw it very far into their midst with one swing, while himself did boldly crouch beneath his shield.

“And the Cholchians gave a mighty cry, like the cry of the sea when it roars on jagged rocks, but on the king Aetes came dumb dismay at the hurtling of that mighty quoit. Then did they like sharp-toothed dogs leap upon it, and with loud yells did rend each other; and they were falling on their mother earth beneath their own spears, like pines or oaks, which sudden gusts of wind do shake.”

The heroes then seize the fleece, and accompanied by Medea, set out again for home. Many new adventures beset their path, but all their dangers they overcome and finally reach the shores of Thessaly.

CHAPTER 4

DINNER WITH ARCHIMEDES

1. *The Guests Assemble.*

A FEW NIGHTS AGO WE MET IN the Museum a distinguished guest from Syracuse. His name was Archimedes and he was introduced to us as a friend and relative of King Hero of that illustrious city. That he was regarded here in Alexandria as a man of more than ordinary worth is attested by a letter which has just arrived for us from the Royal Palace. For in this letter King Ptolemy Philadelphus has invited us to be present at an informal dinner which he is giving in honor of the distinguished visitor. We are made to understand that other members of the Museum will be present and that the affair will give us an opportunity to become familiar with the many interesting ideas advanced by Archimedes.

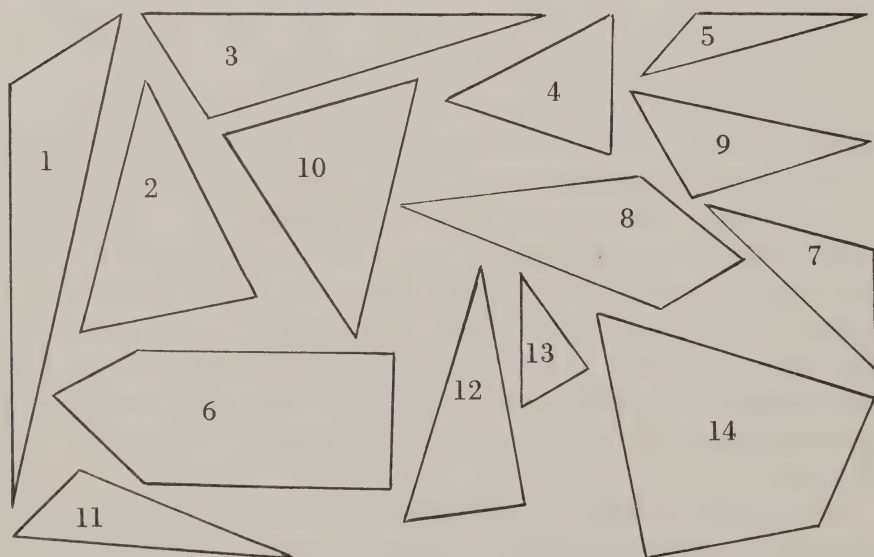
Since this is the year 250 B. C. Philadelphus, the great patron of the arts and sciences, has been upon his throne for thirty-five years and during this period the affairs of the Museum have greatly prospered. The king himself is now nearing the age of sixty; although he suffers considerably from the gout, he still retains a lively interest in the affairs of the mind. Queen Arsinoe has been dead these twenty years or more, and the occasional state affairs held in the Royal Quarters lack the sparkle and the zest which her striking personality once gave to them. In his declining years the king has become much fonder of these quiet parties where small groups of chosen friends can survey the affairs of the busy world. It is fortunate, indeed, that this powerful and wealthy monarch finds pleasure in association with great scholars, a phenomenon with few parallels in the history of empires.

Since this is to be a feast of reason rather than a trencherman's festival, the guests assemble in a private room in the Royal Palace. As we are ushered in, we find that Archimedes has arrived before us

and he and the king are busily engaged with a set of ivory blocks. "May the gods bring a plague upon your trick!" mutters the king. "But show me not how it goes, my friend from Syracuse, for it will help to wile away some of my tedious hours." With these words the king sweeps the blocks into a silver bowl and rises to receive us.

"Archimedes has just been showing me one of his puzzles," says Philadelphus. "He wants me to fit these fourteen figures into this square box. He tells me that each of these ivory demons represents some multiple of one part in forty-eight of the square itself. If I ever get the key to the puzzle I shall have rare fun with the dioketes, who has been giving himself airs of late."

This puzzle of Archimedes appears to have been one of the first of that long succession of "cut-out" games, which have amused the human race through the centuries. It apparently remained in vogue for many years and the name *loculus Archimedes*, or box of Archimedes, seems to have been used to represent any cleverly fashioned puzzle. But whether this invention adds luster to the name of the great scholar for all of that the reader must decide for himself. He may find amusement, however, in attempting to solve on his own account the problem which so baffled the king. The various polygons are given in the accompanying figure. The solution of the problem



The puzzle invented by Archimedes.

will be found in the diagram at the end of the chapter. The reason why Archimedes chose his peculiar divisions of the square is unknown, for we are ignorant of the origin of the puzzle.

The guests are now assembling and some of these we have already met in the Museum on the occasion of the discomfiture of poor Apollonius. Theocritus and Callimachus are present, but since science is to be the principal dish at the banquet, no others of the literati have been invited. For then, as now, the paths of the arts and the sciences lead in divergent ways. Conon, the astronomer, presently makes his appearance for he is one of the most intimate friends of the distinguished guest.

"And here is Eratosthenes," says the king, "who is soon to leave us for the shrines of Athens. I envy him the trip and may the gods prosper him on his journey."

Eratosthenes was in high favor with the king for he had undertaken the task of writing the biography of Queen Arsinoe. This he appears finally to have completed for we find the following quotation from it cited by Athenaeus:¹

"Ptolemy founded all kinds of feast and sacrificial days, specially those associated with Dionysus; and Arsinoe asked the man who carried the olive branches what day he was then celebrating and what festival it was. He answered: 'It is called Flagon-bearing, and the celebrants eat what is brought to them while they recline on beds of rushes, and each man drinks out of a special flagon which he brings from his own house.' When he had left, she looked at us and said: 'That must be a dirty get-together. For the assembly can only be that of a miscellaneous mob who have served themselves with a stale and utterly unseemly feast.'"

Two men of mature years now enter the room and they are greeted with great respect by the king.

"I suppose you haven't yet found the reasons why men grow old nor why I suffer the pangs of torment in my legs," says Philadelphus jestingly. "My friends, to most of you the names of Erasistratus and Eudemus need no introduction. But to the others who come from a

¹ l. vii, 276.

distance, let me present Erasistratus, who knows more about what goes on within our bodies than the priests in the temples; and also his colleague, Eudemus, who wields the sacrificial knife, but looks at the viscera of his victims with an eye to what he sees and not to the omens that they portend."

You may well believe that we regard these men with deep interest for Erasistratus was the founder of the science of Physiology, while Eudemus was the successor of Herophilus, the founder of Anatomy, in the days of the Museum under the first Ptolemy.

Two other guests now arrive and they are greeted cordially by Archimedes. "I have not yet paid my respects to you during this visit of mine in Alexandria," he says, "for you are ever busy with your observation of the sky. What new things have you now to tell us?"

"Curious matters there are among the stars," one of them replies, "but only patient measurement will tell us their secrets." These men, we understand, are Timocharis and Aristyllus, able astronomers, who are mapping the heavens and fixing the places of the stars by a system of their own devising. In a later century their careful work was to prove of inestimable value to Hipparchus in his profound studies upon which so much of modern astronomy has been founded. Pass them not by, if their work does not scintillate as that of others, *for science is built upon the labors of such as these.*

Several other guests now enter the room and among them are two whom Archimedes greets with special interest and affection. Their names, we learn, are Zeuxippus and Dositheus, and they carry on the mathematical tradition established by the great geometer Euclid. We do not know the nature of their special interests, but they were so highly regarded by Archimedes that several of his treatises were later dedicated to them.

"I am sorry," says the king, "that Ctesibius, my engineer, cannot be with us tonight, but he is away on certain affairs of state. You know that he has an ingenuity second to none, and he is contriving certain machines of war which will greatly concern our enemies, if any are rash enough to attack us. The god Hephaestus himself would envy his workshop and his forges. But our guest of honor is also very wise in these matters, as I hear from our colleague, King

Hiero of Syracuse, and perhaps later he can be prevailed upon to tell us something of them."

We chat a while and the king keeps his eye expectantly upon the door. Suddenly there is a clatter outside and in a moment a young man nearing thirty hurries into the room.

"I beg your pardon, father," he says, "but I tarried too long at the harbor. 'Tis a mighty ship that King Hiero has just sent in and I have spent the afternoon looking over its handy devices. It is the very ship, I understand, that Archimedes launched so wondrously a short while ago."

Philadelphus greets the young man affectionately, and with obvious pride presents him to us.

"This, as most of you know, is my son," says the king. "Since my eyes grow dim and my legs feeble, the time draws near when he must carry on our work. My father took a special pride in the Museum; he learned the value of wisdom from the great Alexander, who discovered it on his part from Aristotle. And now one sees how important it is that the torch be passed along to younger hands. It is my wish and hope that the next Ptolemy will continue the tradition established by his grandfather and that he will keep the torch burning brightly in the years to come. It is for this reason, my friends, that I have asked him here tonight to dine with us so that he may learn the ways of scholars like yourselves."

These fine sentiments, we are pleased to say, were well heeded by the prince, who under the name of Euergetes, that is to say, the Benefactor, continued in later years the patronage of his predecessors.

2. Archimedes Discourses on an Apple.

The company is now ushered into the dining hall. Washing our hands in the golden bowls provided for us, we take our places upon the comfortable couches. Philadelphus presides over the gathering with the prince on one side and Archimedes on the other. Although the banquet provided for us is in keeping with the customary lavishness of the court, we note that the king partakes sparingly of the dishes placed before him and dines mainly on lentil porridge.

"It has come to my ears," says the king to Archimedes, "that

you have just made a discovery which you regard very highly. It concerns a figure like this apple here; but what more you can say, than that it is round like the moon, perhaps you will be good enough to tell us."

At this the face of Archimedes lights up with pleasure, for of all the things that he has discovered this touches his pride the most.

"There is much more in the matter than mere roundness," says Archimedes. "For suppose that you consider this apple completely enveloped by a cylinder, the top and bottom touching as well as the curved surface. What can one now say about the volume of the sphere and its container, as well as about the area of the two surfaces?"

Although the answer to this problem can be obtained readily enough today by any bright school boy, it presented real difficulties in that distant time. For the first man who tried it, without the tools of modern mathematics at his disposal, found the road beset with thorns.

"The answer to this puzzle," says Archimedes, "is as beautiful as it is surprising. *For both the volume and the surface of the sphere are to the volume and the surface of the circumscribing cylinder as two is to three.* In connection with this study I have also been considering another matter, namely, the ratio of the circumference of the circle to its diameter. All of you know that this number is more than three but less than four. But who among you can tell me by what portion of the whole it exceeds three?"

Today, by modern methods as elegant as they are powerful, we can answer the question of Archimedes by citing the decimal approximation of this ratio, our familiar number π , to the unbelievable value of more than 2,000 decimal places. But the first mathematicians struggled valiantly to attain a fair estimate of this important number. By obtaining the lengths of polygons inscribed and circumscribed about a circle, Archimedes finally concluded that "the circumference of a circle exceeds three times its diameter by a part which is less than $1/7$ but more than $10/71$ of the diameter." In terms of this magic number, then, Archimedes was able to give the volume and the surface of the sphere. His own estimate of the elegance of these results is seen in the following quotation from Plutarch:¹

¹ *Life of Marcellus*, 16.

"And although he made many excellent discoveries, he is said to have asked his kinsmen and friends to place over the grave where he should be buried a cylinder, enclosing a sphere, with an inscription giving the proportion by which the containing solid exceeds the contained."

Centuries later Cicero found the tomb of the great scientist, covered over with brambles and neglected by the people of Syracuse. The account, as given in the *Tusculan Disputations*¹, is worth repeating here:

"When I was quaestor I hunted out his grave, which was unknown to the people of Syracuse, since they entirely denied its existence, and I found it completely covered and surrounded by brambles and thorn-bushes. For I recalled some little verses, which I had heard had been inscribed upon his monument, and which declared that a sphere and a cylinder had been placed on the top of the sepulcher. And thus, after I had surveyed everything, since at the Agrigentine gate there are many graves, I observed a small column emerging from the thorn-bushes on which there were the figures of a sphere and a cylinder. And thereupon I said to the Syracusans, for I had their leading man with me, that I thought this was what I was looking for. Slaves sent in with sickles cleared and uncovered the place. When a passage had been made to it, we approached the pedestal facing us; the epigram was apparent with about half of the little verses worn away. And thus one of the noblest cities of Greece, once, indeed, a very great seat of learning, would have been ignorant of the monument of its most brilliant citizen, except that it was revealed by a man of Arpinum [Cicero]."

3. *The Sun, the Moon, and the Earth.*

While Archimedes was thus describing his investigations into the geometry of the sphere Conon had picked up an apple and was regarding it with speculative eye.

"But perhaps that is not all that we can see in this piece of fruit," he now remarks. "For unless our observations are in vain, the earth

¹ v, 23.

on which we live is shaped like this, as also the moon and the sun, and the great universe of stars itself. Tell us, Archimedes, what do you make of these puzzles?"

"That is a question which should be answered by our friend Aristarchus of Samos," replies Archimedes. "For he is wiser than any of us in these matters."

"We know him well in Alexandria," interposes the king. "He has made observations here and I have thought to secure him as a permanent member of the Museum. But what thinks he on these matters?"

"We all agree that the earth is spherical," says Archimedes. "But no man has yet measured its size exactly. I myself put the circumference at not more than three million stadia [345,000 miles], although, until there is more evidence, we must regard this as subject to gross error. How great this error may be you can readily see since others have made the estimate one-tenth of this. The matter needs settling. Perhaps Eratosthenes here is just the man to solve the problem."

"And what about the sun and the moon?" asks the king. "Since they are round also, they must compare with the earth. What say you about these?"

"That is a hard question," replies Archimedes. "But we all agree that the diameter of the earth is greater than the diameter of the moon, and the diameter of the sun is greater than the diameter of the earth. But as to what these ratios are there exists much difficulty in knowing and a great difference of opinion. Eudoxus declared that the diameter of the sun was nine times that of the moon, and Phidias, my father, said that it was twelve times, while Aristarchus tries to prove that the diameter is greater than eighteen times, but less than twenty times the diameter of the moon. But my calculations show that this diameter may be as much as thirty times the diameter of the moon."

At this point Timocharis interposes an objection. "These measurements are very hard to obtain accurately, for the tools in our hands are not made finely enough to determine the small angles with which we deal. For example, Aristarchus must determine, at the exact moment when the moon is half full, the angle between lines drawn from the earth to the centers of the sun and the moon. He finds this angle to be the one-hundred and twentieth part of the circle of the

Zodiac [that is, three degrees] smaller than one right angle. But Archimedes now affirms that the deficiency is but two-thirds of this."

"Your remarks are well taken, Timocharis," admits Archimedes, "and it may be years before we know the truth. However, Aristarchus is on much better ground in his estimate of the size of the moon. He finds its diameter to be about one part in three of that of the earth."

And such indeed was the case, for Aristarchus, by ingenious methods, actually determined that the diameter of the moon was 0.36 that of the earth, which compares not too unfavorably with the modern value of 0.27.

4. *The Heliocentric Theory of the Universe.*

"We should like your opinion about another matter," says Aristyllus. "Timocharis and I have debated the question much with Conon recently. For in a letter to us Aristarchus has set forth a very strange theory. He asserts that the sun is fixed in the firmament and that the earth and the planets revolve around it in their annual journey."

At these strange words Callimachus begins to show agitation. "I am afraid that our learned friend from Samos must be in error here," he says, "for his words are contrary to the teaching of all the poets and defy the gods themselves. I don't believe that many of us in this modern time subscribe to the words of Mimnermus, who lived so long ago [about 630 B. C.], beautiful though they are. You know the passage doubtless:

"'Yea, even the Sun-god hath received the lot of toil all his days, nor ever cometh any surcease for his horses or for himself, when rosy-fingered Dawn hath left Oceanus and mounted the sky; for a lovely winged hollow couch of precious gold, made by the hands of Hephaestus, bears him lightly across the billow, on the top of the wave, while he sleeps; it carries him from the land of the Hesperides even to the country of the Ethiopians, where his swift chariot and steeds stand waiting until early-born Dawn shall come. Then the son of Hyperion mounts his car.'

"But surely there are few among us who would deny the words of Aratus, our fellow poet, who puts the matter thus in his *Phenomena*:

"['The stars], all alike though they be ... are drawn across the

heavens always, through all time continually. But the Axis shifts not a whit, but unchanging is forever fixed, and in the midst it holds the earth in equipoise, and wheels the heaven itself around.”

“That is, indeed, well put,” replies Archimedes, “but I think we must eye the matter from another angle. If Aristarchus is right in his conjecture, then the fixed stars must be much further away than we ever supposed them to be. For any man can see that they shift not from their places in the sky as would surely be the case if the earth moved around the sun and the stars were not far out beyond the universe.”

“Tell us, Archimedes, what think you of the sun itself?” asks the king. “The poets tell us that once he drove his chariot too near the earth and scorched it. Have you any estimates of the distance from our earth to this burning sphere which gives us light and heat and all good things?”

“Aristarchus again has made some estimates,” replies Archimedes. “As any one may observe in the case of eclipses of the sun, the shadow of the moon sometimes just covers and sometimes does not quite cover the disc of the sun. Then, by a simple theorem in Euclid, we know that their diameters are to each other as their distances from the center of the earth. The difficulty comes in trying to estimate these distances. But Aristarchus, by methods which I cannot now describe to you, has finally concluded that the distance from the earth to the moon is nine and a half times the diameter of the earth. From this then we may infer that the diameter of the sun is six and three-quarters times the earth’s diameter and that its distance is one hundred and eighty in terms of this same unit.”

But remarkable as these calculations were, and theoretically accurate as the method was by which the distances were inferred, the crude instruments of the early astronomers made hopelessly great errors in these estimates. The difficulties of measurement may be readily seen from the fact that modern observations have shown that, in terms of earth-diameters, the mean distance of the moon is 30.2, the mean distance of the sun from the earth is 11,726, and the diameter of the sun is 108.9. But one may marvel, nevertheless, that these first approaches to a problem of such great observational difficulty should have yielded the diameter of the moon accurately, and

given the other values in their proper relative size. Employing the methods of Aristarchus and Archimedes, their successors – Hipparchus, Posidonius, and Claudius Ptolemy – were able to make considerable improvement in these values at a later time.

5. *Archimedes Discusses Some Very Large Numbers.*

“I have heard recently that you have made some attempts to measure the grains of sand in the universe, and also in the sphere of the fixed stars,” interposed Zeuxippus. “Can you tell us something about these computations, Archimedes?”

It will be observed from this that among the ancient astronomers the word *universe* was used technically to mean the sphere which contained the earth at its center and had a radius equal to the distance to the sun.

“The difficulty with this problem,” replies the mathematician, “is found in the size of the numbers. For as you know we have given names to numbers only up to a *myriad* [10,000]; and this, while it may estimate the size of armies, is a very feeble tool when we are talking about the distances to the stars. But of course we can still speak of a myriad of myriads [100,000,000], which gives me a set of numbers that I shall call *numbers of the first order*.”

“Such thoughts make my head whirl!” says the king.

“But now if we take a myriad of myriads as a unit of a second order, then a unit of this unit will carry us to a unit of the third order, if you follow me. We can, as you clearly observe, form a myriad of myriads of such orders, and then we shall have a number of such vast proportions that it should measure all things in the universe.”

“However, even this number some day might not suffice for us,” objects Zeuxippus. “Then your system would need to be revised.”

“An excellent objection,” replies Archimedes, “and I have given thought to this also. For when we reach a myriad of myriads of orders, then this vast number may be called a unit of *the first order of the second period of numbers*. And when we have reached the myriad of myriads of such numbers, then the new unit will start a new series. This new quantity we have called the unit of the second order of the second period. And even the gods themselves could probably find nothing to measure with the unit of the myriad of myriads order of the myriad of myriads period; and with that we have concluded our scheme.”

There is dead silence in the room when Archimedes finishes his survey of this astonishing system of numbers. For what, indeed, could be measured with this vast unit? The last number in the last order, if written out in our own decimal system, would start with 1 and be followed by eighty quadrillions, that is to say, 80,000 million millions, of cyphers.

Even the most extravagant demands of modern cosmology, let us say the expression of the radius of space in terms of the radius of the electron, or the enumeration of all the electrons in the universe, would find this scheme of Archimedes sufficient for its purposes. However, if one assumes a modern estimate that the number of electrons in the visible universe is of the order of 10^{83} , then the number of possible permutations of this swarm of particles would make necessary the addition of a third category to the Archimedean scheme.

That the concept of such immense numbers has already had one victim we now observe; for poor Theocritus is dozing over his wine.

6. *On the Grains of Sand in the Universe.*¹

"This is, indeed, interesting," says Conon, "and astronomy has need for such a system. But I am sure that all of us would like to know how you use it in finding the number of grains of sand in the universe by your sand-reckoner."

"To make this estimate I must have some assumptions," says Archimedes. "I shall use very fine sand, for I shall think of a poppy-seed, let us say in diameter not less than one part in forty of a finger's

¹ For those who wish a more detailed account of the ingenious system of numbers devised by Archimedes and his computations of the number of grains of sand in the Universe, the following explanation in symbolic terms may suffice:

Since a myriad is 10^4 , which we shall designate by m , a myriad of myriads is $m^2 = 10^8$, a number which we designate by M . This is the fundamental unit of the Archimedean system and it is called by him the unit of the *first order*. Similarly the number M^2 is the unit of the *second order*, M^3 the unit of the *third order*, etc. The unit of the M th order, namely, M^M , is given a new designation, being termed the unit of the *first period*. If we denote this number by P , then MP is the unit of the *first order of the first period*, M^2P the unit of the *second order of the first period*, etc. until we reach P^2 , which is called the unit of the *second period*. Proceeding in this manner we come finally to the number P^M , which Archimedes calls the unit of the *myriad of myriads order of the myriad of myriads period*. This unit, which we shall

breadth, as containing a myriad [10,000] of grains of sand. Since the volumes of spheres are to each other as the triplicate ratio [cubes] of their diameters, we see that a sphere of diameter equal to the breadth of one finger will contain something around 64,000 poppy-seeds, or six units of the second order and 4,000 myriads of the first order grains of sand."

"My head still whirls!" says the king.

"Since we need a stylus and a waxen tablet to show these next estimates, I shall merely give you the final answer. If we use my figure of 10,000 earth-diameters as the diameter of the universe, then the number of grains of sand which would be contained therein is less than 1,000 units of the seventh order of numbers [or 10^{51}]. And

denote by R , is thus seen to be $R = P^M = (M^M)^M = M^{M^2}$.

In order to count its digits we form the logarithm of R and thus have

$$\log R = M^2 \log M = 8 \cdot (10)^{16} = 80,000,000,000,000,000.$$

In modern notation the computation of the number of grains of sand in the Universe proceeds as follows:

Archimedes assumed that one poppy-seed contained a myriad of grains of sand, $m = 10^4$, and that one poppy-seed had a diameter equal to one-fortieth of one digit (finger).

Hence, in a sphere of diameter equal to one digit, there will be $(40)^4 \times 10^4 = 64 \times 10^7$ grains of sand. This is less than 10^9 . Since m digits = one stadium, we thus find that there will be less than $m^3 \cdot 10^9 = 10^{21}$ grains of sand in a sphere of radius equal to one stadium.

Archimedes then introduced his assumption regarding cosmic distances, which may be stated in the following ratios:

$$\frac{\text{Diameter of the globe of the stars}}{\text{Diameter of the sun's orbit}} = \frac{\text{Diameter of the sun's orbit}}{\text{Diameter of the earth}} = m.$$

Making a gross over-estimate, Archimedes then assumed that the diameter of the earth was less than 10^6 stadia. Hence, noting that the diameter of the sun's orbit was also called the diameter of the universe, we obtain the inequalities:

$$\text{Diameter of universe} < m \times 10^6 = 10^{10}; \text{Diameter of globe of stars} < m^2 \times 10^6 = 10^{14}.$$

From these inequalities it follows that the number of grains of sand in the universe is less than $10^{21} \times 10^{30} = 10^{51}$, and the number of grains of sand in the globe of the stars is less than $10^{21} \times 10^{42} = 10^{63}$. Since the first of these numbers is equal to $10^3 \times M^6$ and the second is $10^7 \times M^7$, it is clear that they belong to the sixth and seventh orders of the Archimedean numbers, respectively.

then, if we finally employ a sphere of the size attributed by Aristarchus to the sphere of the fixed stars, the number of grains of sand would be less than a thousand myriads of units of the eighth order of numbers [or 10^{63}].”

Archimedes now fixes his eye upon Eratosthenes. “You may have use some day for these large numbers. I have a problem to propose to you. It concerns a vast herd of cattle that once filled the plains of Thrinalia, stretching away as far as the eye could see them. In this herd there were bulls of four colors and cows of four colors and the relation of the numbers in each group I shall give to you at another time. I may say, however, that the sum of the white bulls and the black bulls forms a perfect square, while the sum of the yellow and the dappled bulls is a triangular number, like 3, 6, 10, and so on.”

This famous “cattle problem” of Archimedes was notable for two things. First, it was a predecessor of that long line of numerical puzzles, which involved the solution of equations in terms of integers alone. Second, the answer to the problem was unbelievably large, since just to enumerate the number of animals in each of the eight categories, there would be required something like 600 pages, each containing 2,500 figures. That Archimedes, or the unfortunate Eratosthenes to whom the problem was proposed, ever achieved the solution may be justly doubted; that they developed a method for solving it is possible.

7. Archimedes Launches a Ship.

Since the imagination of those present, even that of the astronomers, is quite dazzled by these immense figures, the conversation soon shifts to other matters.

“Tell us about your launching of the great ship which I saw in the harbor today,” says the prince, entering the conversation for the first time. “For I have heard that you contrived to do alone the task that many men would do for us.”

“That matter was much simpler than you would think,” replies Archimedes, “for I made use only of the principle of the lever. Thus you see how neatly this spoon balances upon my finger although the bowl is much heavier than the handle. The matter came about rather curiously, however, for one day when I was discussing this problem

with King Hiero, in the heat of explaining the great power in the lever, I made the rash statement that, given a place to stand upon, I could even lift the earth itself. But King Hiero, who always had his eye on the practical, told me that, while he could not furnish me another earth with which to try my powers, there was a large ship in the harbor that wanted launching and perhaps I might try my skill on it. You see that I was craftily caught."

"Archimedes is too modest to tell the rest of the story," says Conon, "but I know it well and perhaps it would be best for me to finish it. Our learned and skillful guest thereupon set up a multitude of ropes in the shipyard, compounding many times the force of the simple lever. He then invited a large number of people to board the vessel and instructed the workers to fill it with its customary freight. Thereupon, seated at a distance, he manipulated his pulleys and the great ship glided smoothly into the water."

At this recital of Conon there is great applause from the guests and the king instructs his son to make a note of these devices for use in the shipyards in Alexandria.

8. *The Story of King Hiero's Crown, and Other Matters.*

"Tell us another thing," says the king. "Occasionally the officers of the treasury have difficulty in knowing whether a quantity of gold coins may not be debased with silver or other metal. But I hear that this problem was once proposed to you with respect to a crown by King Hiero. And I also understand that you gave him the solution to it."

"That was, indeed, a distracting matter," says Archimedes smiling. "And unfortunately the solution came to me in my bath. They tell me that I ran out into the public square without my clothes, crying 'Eureka! Eureka!', after I had discovered the key to the riddle. Be that as it may, the principle is one of great interest and usefulness and can be stated as follows: A solid which is heavier than a fluid will, if placed in it, descend to the bottom of the fluid, and the solid will, when weighed in the fluid, be lighter than its true weight by the weight of the fluid displaced. And so you see, I weighed the crown in water and then in air, and compared these weights with those of known quantities of pure gold and silver."

Now Eudemus, the anatomist, speaks up. "Tell us, Archimedes, have you ever reflected upon the nature of the light by which we see?" he asks. "Those of us who strive to penetrate the nature of the human body need better eyes. For much there is of interest that lies beyond the strength of our vision."

"I am writing a treatise on this subject now," replies Archimedes, "but what we yet know is little enough. Light moves in straight lines as everyone knows, and if we curve a mirror ever so little and uniformly, then these rays can be brought into focus at a single point. I am now contriving a device which may be useful in arts of war to set on fire the ships of enemies."

At this the king takes an immediate interest. "Tell us, Archimedes, what do you think of the new methods which our mutual friend Ctesibius is devising to apply these natural forces to the discharge of stones and arrows?"

"I must confess," replies Archimedes somewhat boldly, "as I have often told King Hiero, that my own interest lies in the reasons behind these practical devices, rather than in the machines themselves. A geometrical figure in the sand has much more charm for me than all the engines on the battlements of the city. But I shall gladly describe some of the machines which we are contriving against our enemies, should ever they decide to attack us. They involve the same principles as those now used by your own Ctesibius."

And thereupon Archimedes proceeds to discourse for a while upon the many devices which he had in mind should an enemy attempt the beleaguerment of Syracuse.

Many years after the time of the dinner which we are describing, Marcellus, the Roman general, besieged the city of Archimedes. Since a lively account of this famous siege has been given by Plutarch, who derived his information from the earlier *Histories* of Polybius, we can do no better than to let him describe the consequences¹:

"When, therefore, the Romans assaulted them by sea and land, the Syracusans were stricken dumb with terror; they thought that nothing could withstand so furious an onset by such forces. But Archimedes began to ply his engines, and shot against the land forces of

¹ *Life of Marcellus*, xv-xvii.

the assailants all sorts of missiles and immense masses of stones, which came down with incredible din and speed; nothing whatever would ward off their weight, but they knocked down in heaps those who stood in their way, and threw their ranks into confusion. At the same time huge beams were suddenly projected over the ships from the walls, which sank some of them with great weights plunging down from on high; others were seized at the prow by iron claws, or beaks like the beaks of cranes, drawn straight up into the air, and then plunged stern foremost into the depths, or were turned round and round by means of enginery within the city, and dashed upon the steep cliffs that jutted out beneath the wall of the city, with great destruction of the fighting men on board, who perished in the wrecks.

“Frequently, too, a ship would be lifted out of the water into mid-air, whirled hither and thither as it hung there, a dreadful spectacle, until its crew had been thrown out and hurled in all directions, when it would fall empty upon the walls, or slip away from the clutch that had held it. As for the engine which Marcellus was bringing up on the bridge of ships, which was called *sambuca* from some resemblance it had to the musical instrument of that name, while it was still some distance off in its approach to the wall, a stone weighing ten talents [around 600 pounds] was discharged at it, then a second and a third; some of these, falling upon it with great din and surge of wave, crushed the foundation of the engine, shattered its frame-work, and dislodged it from the platform, so that Marcellus, in perplexity, ordered his ships to sail back as fast as they could, and his land forces to retire.

“Then, in a council of war, it was decided to come up under the walls while it was still night, if they could; for the ropes which Archimedes used in his engines, since they imparted great impetus to the missiles cast, would, they thought, send them flying over their heads, but would be ineffective at close quarters, where there was no space for the cast. Archimedes, however, as it seemed, had long before prepared for such an emergency engines with a range adapted to any intervals and missiles of short flight, and through many small and contiguous openings in the wall short-range engines called *scorpions* could be brought to bear on objects close at hand without being seen by the enemy.

“When, therefore, the Romans came up under the walls, thinking themselves unnoticed, once more they encountered a great storm of missiles; huge stones came tumbling down upon them almost perpen-

dicularly, and the wall shot out arrows at them from every point; they therefore retired. And here again, when they were some distance off, missiles darted forth and fell upon them as they were going away, and there was a great slaughter among them; many of their ships, too, were dashed together, and they could not retaliate in any way upon their foes. For Archimedes had built most of his engines close behind the wall, and the Romans seemed to be fighting against the gods, now that countless mischiefs were poured out upon them from an invisible source.

"However, Marcellus made his escape, and jesting with his own artificers and engineers, 'Let us stop,' said he, 'fighting against this geometrical Briareus, who uses our ships like cups to ladle water from the sea, and has whipped and driven off in disgrace our sambuca, and with the many missiles which he shoots against us all at once, outdoes the hundred-handed monsters of mythology.'

"For in reality all the rest of the Syracusans were but a body for the designs of Archimedes, and his the one soul moving and managing everything; for all other weapons lay idle, and his alone were then employed by the city both in offense and defense. At last the Romans became so fearful that, whenever they saw a bit of rope or a stick of timber projecting a little over the wall, 'There it is,' they cried, 'Archimedes is training some engine upon us,' and turned their backs and fled. Seeing this, Marcellus desisted from all fighting and assault, and thenceforth depended upon a long siege."

At the end of his account of the siege of Syracuse Polybius makes the following pertinent comment: "Such a great and marvelous thing does the genius of one man show itself to be when properly applied to certain matters. The Romans at least, strong as they were both by sea and land, had every hope of capturing the town at once if one old man of Syracuse were removed."

Many other ingenious mechanical devices were invented by Archimedes. One of these was the water screw, which was used widely in Egypt for irrigating fields. According to a description given by Vitruvius, this machine consisted of a screw with spiral channels "like those of a snail shell," which revolved within a wooden pipe. It was operated by man-power, but did not raise the water as high as the water-wheel.

Apparently, also, the first planetarium was constructed by Archimedes and exhibited in Syracuse. It was taken by Marcellus as his

only share of the booty in the sack of the city. The following description of it is given by Cicero in his *De Republica*, on the authority of Gallus, a Roman consul in the year 166 B.C.:

“And in this the invention of Archimedes was remarkable, because he had thought out a way in which, by a single device, he could represent accurately the movements of the planets with their divergent paths and different rates of speed. When Gallus moved the globe thus contrived by Archimedes, it came about that the moon on this bronze device followed the sun by as many revolutions as the number of days it lags behind in the sky. And so it came about that a solar eclipse occurred on the globe just like the real eclipse; and also the moon came to that place where the shadow of the earth was when the sun was [on the side of the earth opposite to the moon].”

When the king had finished plying Archimedes with questions about the character of war engines which he was then devising, Conon again speaks up. “I hear, Archimedes, that you have invented a new method for answering many perplexing questions in geometry,” he says. “Perhaps you might be able to tell us something of these matters.”

9. Conic Sections and the Achievement of Apollonius.

“I hesitate somewhat to do this,” answers Archimedes, “for my method goes beyond the canons of the ancient geometers. Thus I am forced to assume that a geometrical figure can be sliced up, as it were, into an infinite number of lines, which, when added together, make up the whole piece. I then add together all these lines and hence attain the entire figure; but my mathematical friends here may object with much truth that no man can really sum these separate lines and get thereby the area of the original geometrical figure.”

“The idea is certainly a novel one,” admits Dositheus, “and would surely not be allowed by the strict rules of our traditional geometry.”

“However, the results thus appear to be indistinguishable from the truth,” says Archimedes, “and I have used the method in a number of cases. The theorems thus obtained, however, I have endeavored to prove by the accepted logic in such matters. Perhaps I can illustrate it in the case of a parabola.”

"And what, may I ask, is a parabola?" inquires the king.

"A parabola," Archimedes replies, "is one of the conic sections. Euclid wrote four interesting books about these curious figures, but they are worthy of much deeper study. Thus, if we take any right circular cone and cut it by a plane, we shall obtain a geometrical figure which belongs to this family of curves. If the plane is parallel to the base, we clearly have a circle, but if the plane intersects at an angle we shall have, for one direction, a closed figure like an oval, and for another, an open figure with lines extending to infinity. If the plane cuts the cone in a line parallel to the side, then we shall have what we are pleased to call a parabola."

Although Archimedes and some of the mathematicians before him were familiar with the conic sections and had developed many of their properties, the authoritative work on the subject was produced by Apollonius of Perga in a treatise in eight books called the *Conics*. As a result of this work, Apollonius was given the name of the Great Geometer, by which he is deservedly known to all succeeding generations of mathematicians. Apollonius belongs to the history of Alexandria, for he flourished in the Museum during the reigns of Ptolemy Euergetes I (247-221 B. C.) and Ptolemy Philopater (221-203 B. C.). At the time of the banquet which we are describing Apollonius was about twelve years old, for it is conjectured that he was born about 262 B. C. This date is assumed because he dedicated the fourth and following books of his treatise on conic sections to King Attalus I of Pergamum (241-197 B. C.) and was thus probably about twenty-five years younger than Archimedes.

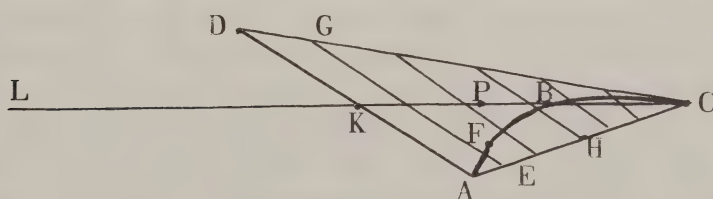
The work of Apollonius is one of the most notable produced in that brilliant assembly of scholars and its influence upon the history of science cannot be estimated. Nearly twenty centuries after Apollonius, René Descartes (1596-1650) wrote his celebrated essay entitled *La Géométrie*, which founded the subject of modern analytical geometry. In this for the first time there was a notable advance over the work of Apollonius for the theorems of the Alexandrian were translated into the language of algebra. But the principal facts about the conic sections did not need to be rediscovered by the new method. The importance of this is well put in the following quotation from Charles Sanders Peirce (1839-1914), an American philosopher:

“Kepler’s discovery rendered Newton possible, and Newton rendered modern physics possible, with the steam engine, electricity, and all other sources of the stupendous fortunes of our age. But Kepler’s discovery would not have been possible without the doctrine of conics. Now contemporaries of Kepler . . . were abandoning the study of geometry . . . because they said that it was so *utterly useless*. There was the future of the human race almost trembling in the balance; for had not the geometry of conic sections already been worked out in large measure, and had their opinion prevailed, that only sciences apparently useful ought to be pursued, the nineteenth century would have none of those characters which distinguished it from the *ancien régime*.”¹

10. *The Invention of the Method of the Calculus.*

In order to make the matter more comprehensible to the king, Archimedes now takes a pear from a dish of fruit on the table and makes a section with a knife which cuts the pear lengthwise. A very presentable parabola is thus made visible.

“And now, if we enclose the segment of the parabola (AFEC) in a



Quadrature of the Parabola.

triangle (ADC) one side of which (DC) is a tangent and the other (AD) is parallel to the axis (BH) of the parabola,” remarks Archimedes, placing the section of the pear upon the table and indicating the lines with two strips of bread, “and if we fix a lever thus (LC), with its fulcrum on the far side of the triangle (K), midway between its ends, then in very truth the segment of the parabola, placed at the

¹ From his *Collected Papers*. Vol. 1, Cambridge, Mass., 1931, p. 32.

far end of the lever (L) will just exactly balance the triangle. And, finally, since the lever-arm of the triangle (KP) is just one third the length of the other end of the lever (KL), I know at once that the area of the parabola is one third the area of the triangle."

There are cries of astonishment from the mathematicians at this novel theorem and the others know that they are hearing the solution of a remarkable problem, although it is quite beyond their comprehension.

"Describe to us, Archimedes, the method which you have used to find this beautiful result," requests Dositheus, his eyes alight with excitement. "There is nothing in Euclid that can give us the clew."

"I fear to tell you this," replies Archimedes, "for it lies beyond the ordinary laws of geometry. But what I do is to weigh each separate line of the parabola against the corresponding line of the triangle [that is to say, EF against EG], and then I add them up, since the area of the parabola must be the sum of all its lines."

At this there is dead silence in the room, the mathematicians looking at one another in amazed surprise. For here in this banquet of the king, these scientists of long ago faced for the first time in the history of man the noble concepts of what has come to be called the infinitesimal calculus. No wonder the bright light blinded them as it did the eyes of men twenty centuries later when Sir Isaac Newton and Gottfried Leibniz rediscovered the principles of the calculus. It is true that Archimedes had not introduced the notion of an infinitesimal, for he thought in terms of lines instead of strips which had small increments for their bases, but many a long year was required to formulate these ideas in a manner acceptable to the rigor demanded by modern mathematicians.

Archimedes is plied with other questions about his great discovery and even those unfamiliar with mathematics catch something of the excitement of the method as the distinguished guest describes how he has applied his theory to obtaining the volumes of various solids. These were, for example, such figures as the sphere, the cone, the paraboloid and hyperboloid of revolution, and oblate and prolate spheroids.

11. *The Spiral of Archimedes.*

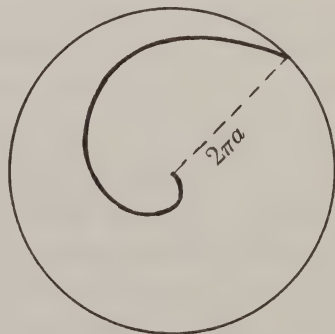
Perhaps the most amazing result of all these astonishing achievements of Archimedes, however, was his investigation of the properties of spirals, which he later published in a treatise entitled *On Spirals*. In the introduction to this work, which he dedicated to Dositheus, Archimedes makes the following interesting statement:

“Of most of the theorems which I sent to Conon, and of which you ask me from time to time to send you the proofs, the demonstrations are already before you in the books brought to you by Heracleides; and some more are also contained in that which I now send you. Do not be surprised at my taking a considerable time before publishing these proofs. This has been owing to my desire to communicate them first to persons engaged in mathematical studies and anxious to investigate them. In fact, how many theorems in geometry which have seemed at first impracticable are in time successfully worked out!

“Now Conon died before he had sufficient time to investigate the theorems referred to; otherwise he would have discovered and made manifest all these things, and would have enriched geometry by many other discoveries besides. For I know well that it was no common ability that he brought to bear on mathematics, and that his industry was extraordinary.”

The curve which has come to be called *the spiral of Archimedes* is described by its inventor as follows:

“If a straight line drawn in a plane revolve at a uniform rate about one extremity which remains fixed and return to the position from which it started, and if, at the same time as the line revolves, a point move at a uniform rate along the straight line beginning from the extremity which remains fixed, the point will describe a *spiral* in the plane.”



The Spiral of Archimedes

Perhaps the greatest achievement of Archimedes, and certainly one of the most astonishing results attained by the great mathematical school at Alexandria was his computation of the area enclosed by

one loop of the spiral. Or as Archimedes put it: "The area bounded by the first turn of the spiral and the initial line is equal to one-third of the first circle," that is to say, $\frac{1}{3}\pi(2\pi a)^2$.

But the hour is now late and although many matters might still be proposed to prolong the conversation, it becomes obvious that the old king is weary. Reluctantly we drink our parting cup of wine, take leave of our generous host and his son, the prince, and accompanied by servants with torches to light our path, we make our way into the cool night air. And as we seek our quarters we reflect once more upon the glories of that ancient city of Egypt and upon the hope that lies for man in the achievements of its Museum.

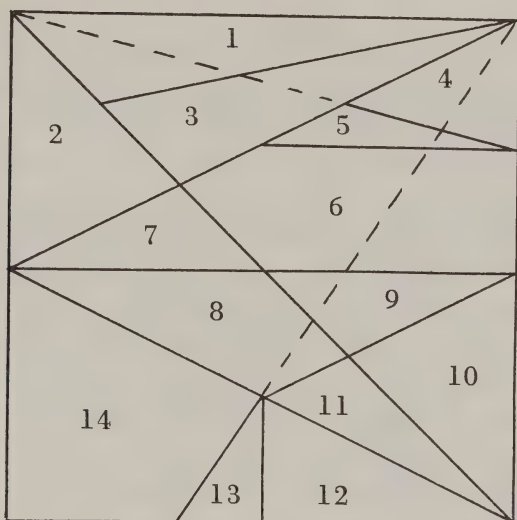
12. *The End of the Story.*

The story of Archimedes has long been known to the world and what he did has been written imperishably upon the records of science. It is to the glory of rulers that they honored him and his memory. Even his death, which occurred in 212 B. C. during the sack of Syracuse, has become a sacred legend of science. The story is told by Plutarch as follows:

"But what most of all afflicted Marcellus was the death of Archimedes. For it chanced that he was by himself, working out some problem with the aid of a diagram, and having fixed his thoughts and his eyes as well upon the matter of his study, he was not aware of the incursion of the Romans or of the capture of the city. Suddenly a soldier came upon him and ordered him to go with him to Marcellus. This Archimedes refused to do until he had worked out his problem and established his demonstration, whereupon the soldier flew into a passion, drew his sword, and dispatched him.

"Others, however, say that the Roman came upon him with drawn sword threatening to kill him at once, and that Archimedes, when he saw him, earnestly besought him to wait a little while, that he might not leave the result he was seeking incomplete and without demonstration; but the soldier paid no heed to him and made an end to him. There is also a third story, that as Archimedes was carrying to Marcellus some of his mathematical instruments, such as sun-dials and spheres and quadrants, by means of which he made the magnitude of the sun appreciable to the eye, some soldiers fell in with him, and thinking that he was carrying gold in the box, slew him. However, it

is generally agreed that Marcellus was afflicted at his death, and turned away from his slayer as from a polluted person, and sought out the kindred of Archimedes and paith them honor."



The Solution of the Puzzle of Archimedes

CHAPTER 5

THE CHARACTER OF THE PTOLEMIES

1. *Ptolemy, the Deliverer*

IF ONE IS VERY GOOD or very bad, or if he is wise beyond others or given to egregious follies, or if great fortune smiles upon him, or if he is overwhelmed by tragic circumstance, then will the poets immortalize his name and the hand of history write his biography and recount his deeds. So has fame and legend treated the dynasty of the Ptolemies, Kings of Egypt, who for three centuries dwelt in the palaces of the Lochias in Alexandria.

Thus sang the poet Theocritus of Philadelphus¹:

“A kindly man, a friend of art and song,
A lover, and the pink of courtesy;
A man that knows his friends, his enemy
Still better, giving largess unto many,
And ne’er refusing to a suppliant
Aught that a king should grant.”

But of Philopator, the fourth Ptolemy, we find a different picture in Polybius², — not encomiums of praise, but a stark and sorry realism:

“When Ptolemy surnamed Philopator, at the death of his father, after making away with his brother Magas and his partisans, succeeded to the throne of Egypt, he considered that he had freed himself from domestic perils by his own action in thus destroying his rivals, but that chance had freed him from danger abroad. . . Secure therefore in his present good fortune, he began to conduct himself as if his chief concern were the idle pomp of royalty, showing himself as regards members of his court and the officials who administered Egypt inattentive to business and difficult to approach, and treating with entire negligence and indifference the agents charged with the

¹ xiv. ² *History*, v, 34.

conduct of affairs outside Egypt... But this new king, neglecting to control all these matters, owing to his shameful amours and senseless and constant drunkenness, found, as was to be expected, in a very short time both his life and his throne threatened by more than one conspiracy."

Vested with great power, the strong and worthy give golden periods to their state, but when this power passes to the weak and evil, then, indeed, do all noble matters — the arts, and literature, and science — decline and disappear. So shall we find it with the Ptolemies, whose history we must sketch if the reader is to understand the reasons for the glory of Alexandria and why those ancient people failed finally to carry on the great works which they had started.

Ptolemy, called in later times Soter or the Deliverer, was the son of Lagus, a Macedonian nobleman of Eordaea. Born in the year 367 B. C. he was 33 years of age when Alexander seized his destiny and crossed the Hellespont into Asia. As perhaps an older companion of Alexander during their boyhood, for the difference in their ages was only eleven years, Ptolemy was evidently one of the king's most trusted companions. According to Arrian¹ he was appointed to be one of his confidential body-guards when the post was vacated by the arrest of Demetrius on suspicion of treason to the king. We hear of him again in the siege of the Indian stronghold on the rock of Aornus, a fortress so impregnable that, according to legend, even Hercules had failed to take it. He appears once more in the famous "marriage of Europe and Asia," which we have described in another chapter, where he received as a bride the Princess Artacama, daughter of Artabazus, although this oriental maiden is heard of no more in the history of Ptolemy. Instead, her place seems to have been taken in the affections of the general by the courtesan Thais, favorite also of Alexander, by whom she had two sons and a daughter.

Although the parts played by Ptolemy in the adventures of Alexander thus do not appear to have been spectacular, they must have been substantial for in the summer of 323 B. C., when the great crisis came with the sudden death of the conqueror, we find Ptolemy regarded as one of the most important men in the council. When the first shock of Alexander's passing was over, there began an immediate struggle

¹ iii, 27.

to divide the spoils of the vast territory that had been conquered. The empire naturally fell into three spheres, the Macedonian one centering around Pella the capitol city, the Asiatic one dominated by the ruler of Babylonia, and the Egyptian domain which was to be governed by the infant city of Alexandria. Between these great areas there were naturally disputed lands, such, for example, as Syria and Palestine, and such island kingdoms as Cyprus and Rhodes.

In the first council of the chieftains the question of the successor to the empire was debated. The only choice was a sorry one indeed. Should the crown go to Philip Arrhidaeus, the half-witted son of Philip II, the father of Alexander, or to the conqueror's posthumous child by his wife Roxana, the unhappy infant Alexander? It was finally decided that a joint regency should be established and this supreme post was given to the general Perdiccas, into whose hands Alexander had passed the signet ring as he was dying. To Antigonus was given the satrapy of Phrygia and to Ptolemy the satrapy of Egypt.

We have not time to follow all the details of the great struggle for power that then ensued, — how finally after nearly a half century of bloody internecine strife between the old generals of Alexander and their sons and grandsons, three solid empires finally emerged, one dominated by the house of Antigonus in Macedonia, the kingdom of the Ptolemies in Egypt, and the empire of the Seleucids, extending from India to the Aegean sea, dominated by the house of Seleucus, who after the death of Perdiccas had been made satrap of Babylonia. For we must tell the story of the Ptolemies and what they did in Egypt.

When Ptolemy came to assume the governorship of Egypt he found that it was in charge of Cleomenes, who had been appointed by Alexander as financial controller of the Nile region. This man, it appears, had been an evil and tyrannous servant and the first act of the new ruler was to put him to death. In fact, there is evidence to show¹ that Alexander himself had been aware of the character of the stewardship of Cleomenes and even Demosthenes in his speech against Dionysodorus affirms that he did no small harm to Athens and to other Greek cities by raising unduly the price of grain. The execution, therefore, was undoubtedly popular and probably well deserved.

¹ Arrian, vii, 23.

The next act of Ptolemy was one of great political sagacity, namely, to secure for his new city the body of Alexander, a feat which we have already described in detail in another place. In the process of gaining this sacred relic Ptolemy also accomplished the destruction of Perdiccas, who had invaded his domain.

2. The Wars of the Succession

And now began the long wars of the succession. In the midst of these intrigues and counterplots every act of Ptolemy seems to have been directed toward one problem, — that of holding Egypt against all aggressors. As part of this campaign he needed, or perhaps desired, the state of Coele-Syria, that is to say, Palestine, on the east, and the powerful state of Cyrenaica, which had given allegiance earlier to Alexander, on the west. The island of Cyprus was also necessary to him as an outpost for his navy.

The struggle over the partition of the empire of Alexander was one which concerned the establishment of a balance of power between the contending forces. It is necessary, in order to understand all that was involved, to get a sketchy picture of the situation. At the time of Alexander's death the homeland of Macedonia was under the regency of Antipater, who still retained it after the partition, by the accident of the death of Perdiccas, in spite of the fact that he was then well along in years. But in 319 B. C. the old leader finally died and left the rule to Polyperchon, one of Alexander's generals, instead of to his own son Cassander. This so infuriated the ambitious young man that Cassander immediately joined the forces of Antigonus in Asia. This was a wise move since Antigonus soon made himself master of the situation, driving Seleucus from his satrapy of Babylonia and wresting the regency of Macedonia from Polyperchon, who was now succeeded by Cassander.

But great alarm began to be felt over the expanding ambitions of Antigonus. It thus came about that in 315 B. C. a coalition was formed against him by Cassander, — a commentary upon the gratitude of princes, — and by Ptolemy, Lysimachus, the governor of Thrace, and Seleucus, who was still an exile from his Babylonian rule.

The struggle for power had begun, which was to shape for at least three centuries, the destiny of the Hellenistic world. Ptolemy, who

had taken possession of Coele-Syria in 318 B. C., was again forced to evacuate these regions as well as to relinquish his hold upon the island of Cyprus. But in 312 B. C. Ptolemy returned again into these regions and, supported by the forces of Seleucus, fought a pitched battle near Gaza in Syria with Demetrius, the son of Antigonus. This was a curious affair since upon that fateful field there were arrayed two armies the chiefs-of-staff of which had been old friends and comrades in the days of the campaigns of Alexander the Great. Together they had lived and together they had experienced both the privations of war and the glories of victory. But war is a game in which great stakes are played for; and in this contest the dice were cast for the vast wealth of both Asia and Egypt. The battle resulted in a complete victory for Ptolemy and his ally. But by that curious courtesy which characterizes Hellenistic struggles, Ptolemy treated his enemy generously, returning to the defeated Demetrius his personal effects and complimenting him upon his bravery.

Ptolemy was in many ways a greater diplomat than a general, and he immediately set about the political conquest of Syria by extending courtesies to the governors of the districts and to the conquered people. It would appear that he also was friendly to the Jewish inhabitants and invited a number of them to settle in Alexandria, for the Jewish quarter was always a large area in that city. We also read in Josephus that "not a few other Jews, of their own accord, went into Egypt, as invited by the goodness of the soil, and by the liberality of Ptolemy."¹

But Ptolemy's hold on Syria was of short duration for Demetrius soon recovered from his defeat at Gaza and with a new force presently drove the Egyptians back to their own territory. One of the results of the battle of Gaza had a far-reaching effect, however, for Seleucus was restored to his satrapy in Babylon. From this victory he later advanced to others and in the course of time established what is known in history as the Seleucid empire, which, embracing much of the territory conquered by Alexander in Asia, was to endure along with the empire of the Ptolemies until both fell victims to the force of Roman arms.

¹ *Antiquities*. xii, 1.

While these things were going on, dire events had taken place in Macedonia. In 317 B. C. Olympias, the troublesome mother of Alexander the Great, had killed Philip Arrhidaeus, the feeble-minded son of Philip II, a debt that she was to pay for in full measure with her own life the following year. In 310 B. C. Cassander slew both the child Alexander and his mother Roxina, as well as Cleopatra, the sister of Alexander the Great. The following year Polyperchon murdered Hercules, the illegitimate son of Alexander, thus bringing to an end the male line of the conqueror.

Upon hearing of these events, and having no longer a reason for recognizing the regency of Macedonia established at the death of Alexander, Antigonus declared himself to be a king. This challenge was soon met in kind by the coalition ranged against him, for Cassander, Lysimachus, Seleucus, and Ptolemy all declared that their domains were now kingdoms, and that they by this act had assumed the royal power. This use of the title of king by Ptolemy appears to have been about 305 B. C.

In the meantime Antigonus had set forth upon a new conquest. Although Ptolemy had succeeded in bringing Cyrene under his control and had placed his step-son Magas on the throne of Cyrenaica (301 B. C.), he now lost the island of Cyprus to Demetrius, and was defeated in a great naval battle at Salamis with a loss of one hundred and fifty ships. As Ptolemy staggered under this blow, Antigonus thought that the time had come when he might make a successful invasion of Egypt. Hence, supported by his victorious navy, he advanced upon Ptolemy with an army numbering nearly a hundred thousand men. But nature and economics worked on the side of the Egyptian king. For while the fleet of Demetrius was becalmed in the waters off the coast of Syria, a violent wind suddenly swept out of the northwest and drove many of the ships upon the shore. And while the army of Antigonus was encamped before the marshlands of the Nile, the agents of Ptolemy appeared among the troops, who were largely mercenaries. Offering them better pay, these emissaries succeeded in transferring many of them to the Egyptian side.

During this period Ptolemy received his title of *Soter*, that is to say, the Deliverer, as a result of these ceaseless struggles. For when the island of Rhodes refused to submit to the will of Antigonus, an army

of some forty thousand men and a fleet of about 370 warships were sent out against them (305-304 B. C.). In their distress the Rhodians appealed to Ptolemy for help, whose prompt answer with ships and men shortly raised the siege. Whereupon the Rhodians consulted with the oracle of Ammon, and were told that they must thenceforth worship Ptolemy as a god, and confer upon him the title of Soter. Thus the king, known to the chroniclers of the adventures of Alexander as Ptolemy, son of Lagus, became thereafter, Ptolemy Soter, king of Egypt.

In the year 302 B. C. the coalition against Antigonus was renewed and Ptolemy for the third time occupied Coele-Syria. But news soon came to him that Antigonus had won a victory over his allies, and he hastily retreated to Egypt. This information proved to be false, however, for in 301 B. C. the armies of Lysimachus, Seleucus, and Cassander won a decisive victory at Ipsus. Antigonus was slain and his forces completely routed.

When the news of this battle reached Ptolemy he immediately occupied Coele-Syria for the fourth time, but the allies did not believe that this territory should be granted him, since he had played no part in winning their victory. This we have on the authority of Diodorus¹ who says: "After his victory over Antigonus, Seleucus marched back to Phoenicia, in order to occupy Coele-Syria in accordance with the terms of the partition. But Ptolemy had already occupied the cities and complained that Seleucus, his ally, should have agreed to accept the territory already occupied by the king of Egypt, and, moreover, that the other kings had not allotted to Egypt, in spite of its participation in the war, any part of the conquered territory. To this Seleucus replied that it was only fair for those who had actually overthrown the enemy in fight to control what they had conquered; yet for old friendship's sake he would not for the present insist upon the matter of Coele-Syria, but in due time would consider his position toward allies who were too grasping."

3. *Ptolemy Consolidates his Empire.*

In the year 295 B. C. Ptolemy recovered the island of Cyprus from Demetrius, and this seems to have been his last engagement in the

¹ *Fragment* from Book xxi.

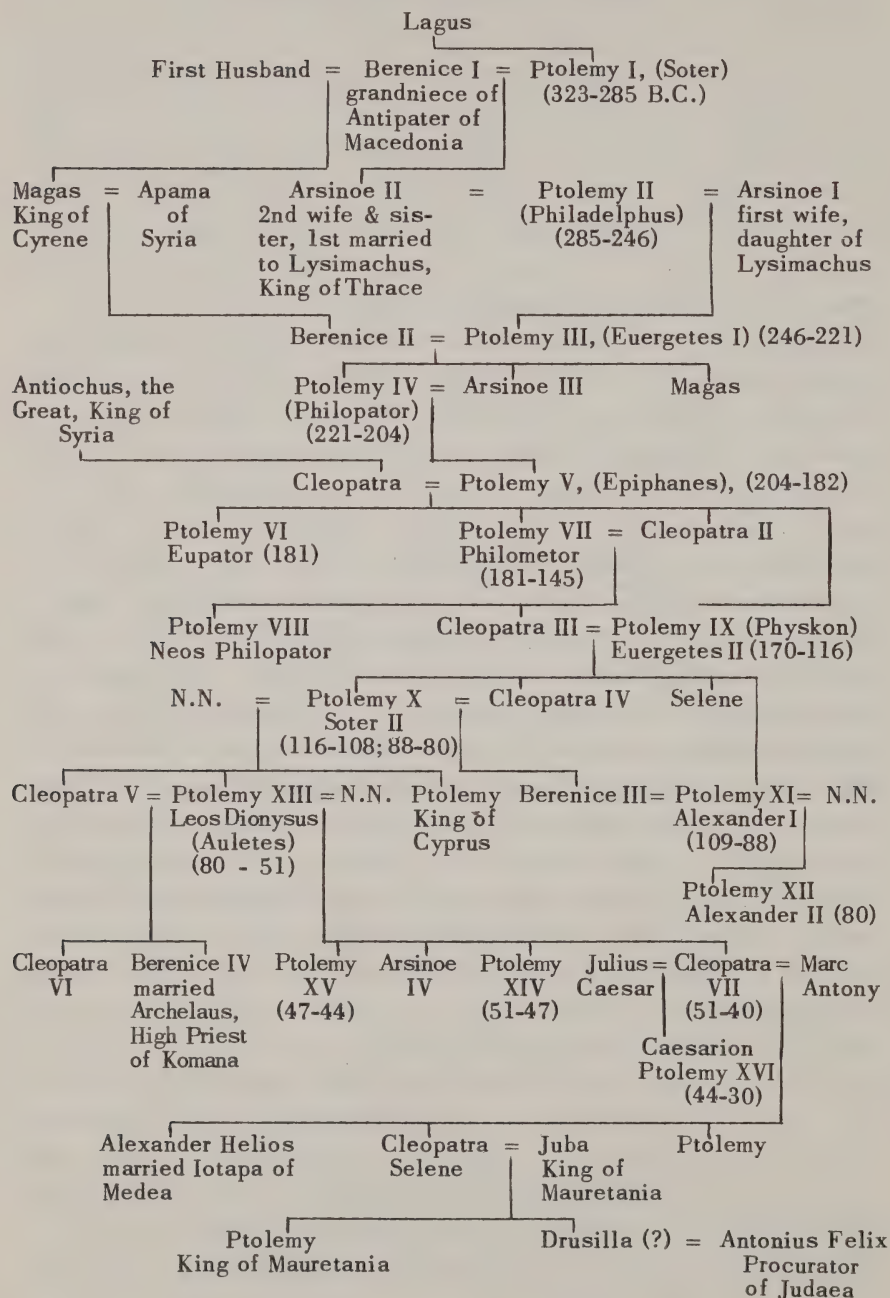
troubled affairs of the Mediterranean. His remaining years were spent in consolidating his empire. He built Alexandria into one of the most beautiful cities in the world, as we have already told; he brought to his shores great scholars, and founded the Museum for them to work in. Probably at this time he wrote his history of the conquests of Alexander, which unfortunately has been lost to us. He patronized the priests of Egypt, and, as we have seen from our visit to the Serapium, he combined the worship of his Macedonian and Egyptian subjects by the clever device of inventing a new god with the attributes of the Greek Hades and the Egyptian Osiris-Apis.

But the king was growing old and the time was near when he must finally relinquish the reign to younger hands. This problem must have given him much concern for he had accumulated a large family and he knew too well the dangers of a kingdom divided against itself. Ptolemy had been married four times, first, to Artakama, his bride in the marriage of Europe and Asia, who seems to have borne him no children; and then to the courtesan Thais, by whom, according to Athenaeus¹, he had three children, two sons, Leontiscus and Lagus, and one daughter, Irene, who married Eunostus, the ruler of Soli in Cyprus. His third marriage was to Eurydice, the daughter of Antipater, who bore him three sons and a daughter. The eldest of these, and the natural successor to the throne was Ptolemy Ceraunus [the Thunderbolt], whose unpleasant history we have already recorded. His daughter was married to Demetrius the Besieger of Greece. The last wife of Ptolemy, and his favorite, was Berenice, the grand-daughter of Antipater, a young widow with a son and two daughters, who had come to Alexandria in the train of Eurydice. She had so captivated the fancy of the king that he married her in 317 B. C. To Berenice was born in 308 B. C. a son Ptolemy, who was to become the next king of Egypt, known to history as Philadelphus.

Because of the violent nature of his eldest son, Ptolemy decided very wisely, it would seem, to hand over the throne to the gentle and popular son of Berenice. In order to consolidate this rather precarious succession, the old king voluntarily abdicated in 285 B. C. and died two years later at the ripe old age of eighty-four years.

¹ *Deipnosophistae*, xiii, 576.

GENEOLOGY OF THE PTOLEMIES



4. *The Golden Reign of Philadelphus.*

As one is well aware from the description which has been given in the first chapter, the reign of Ptolemy II, better known as Philadelphus, was one of the most brilliant in the history of empires. His court, as one has doubtless surmised, compared in many ways with that which Louis XIV maintained in Versailles, where French splendor of a certain kind attained its zenith. The court was adorned by the presence of some of the greatest intellectual leaders of all time; its praises were sung by poets who would be the envy of any age. Philadelphus was surrounded by brilliant mistresses, and the social pattern was given a cast which was both magnificent and dissolute. Side by side with the intellectual powers of the Museum existed the artificial splendor of great feasts and festivals.

Such combinations have been rare in any age, for the history of mankind, during most of its years, has been a record of useless wars, and the somber struggles of people to wrest a scanty living from the earth ravaged by marching men. Thus it is that the court of Philadelphus becomes one of the noticeable events of history. For, despite its tinsel, its golden plate, and purple hangings, this court of the second Ptolemy gives us a glimpse of one of those rare ages, when life was lived to the full, and when, at the same time, the human race took one of those long steps forward toward a better understanding of the universe of nature.

We shall not dwell long upon the history of Philadelphus with whom we are by now so well acquainted. Born in the year 309 B. C., he had reached the age of twenty-four years when his father relinquished the throne of Egypt. Through the wise precautions of the old king, the succession was attended by no disturbances, since both Ptolemy Ceraunus [the Thunderbolt], and his mother Eurydice, with her other children, left the court for other lands.

Philadelphus was a man of mild temperment, and therefore sought no honors in foreign conquests. His principal occupation seems to have been to strengthen Alexandria, increase the prosperity of Egypt, and enjoy high living. He first married Arsinoe, the daughter of Lysimachus, king of Thrace, who had married in his turn the sister of Ptolemy, also named Arsinoe. The unfortunate wife of Ptolemy was apparently a lady given to intrigue, for in time she was caught in a

plot against the life of the king and was banished to upper Egypt. Her place was soon taken by Arsinoe, the sister of the king, who had fled to Alexandria from the Macedonian intrigues, which we have described in the first chapter. The name of Philadelphus, originally conferred upon Arsinoe, was later transferred to her brother.

In the preceding chapters of this chronicle we have spoken at length about the literary and scientific glories of the reign of Philadelphus. Legend attributes to this Ptolemy also the origin of another movement which, in a later day, was to exert tremendous influence upon the patterns of history. This was the introduction of the Jewish *Bible* into the stream of Hellenistic culture.

According to the legend King Ptolemy was persuaded by Demetrius, founder of the Alexandrian library, to authorize a translation of the Jewish law for the archives of the library. The benevolent king, to whom any project which added to the importance of the library made instant appeal, is said to have released some 100,000 Jews held captive in his kingdom, and to have sent an embassy with rich presents to Eleazar, the high priest at Jerusalem, requesting a translation of the Jewish law. For this important project the king asked that six learned men should be selected from each of the twelve tribes and sent to Alexandria to prepare the document.

Eleazar readily consented to the mission and in due time the seventy-two scholars arrived in the golden city with an official copy of the ancient laws. This mission was accorded high honors by the king and sequestered in quarters upon the Island of Pharos so that they might pursue their labors undisturbed. In exactly seventy-two days the work of translation was accomplished. Demetrius, who had accompanied the scholars, recorded each passage as it was approved by the group. A copy of the final translation was presented to the Jewish population of Alexandria and a curse was placed upon any one who should later change this official document. This copy is the origin of what has been subsequently called the *Septuagint* (LXX), or the work of the seventy translators.

This legend of the origin of the translation of the Jewish scriptures is found in a *Letter*, now known to be spurious, written allegedly by Aristeeas to Philocrates. Aristeeas was supposed to be an official of the court and represents himself as a gentile Greek, who was a

member of the original embassy to Eleazar. There is little doubt that the real author of the letter was an Alexandrian Jew who lived during the reign of one of the later Ptolemies. The spurious character of the letter is clearly revealed by internal evidence, as is shown by the fact, which would surely have been known to any contemporary member of the court of Philadelphus, that Demetrius had gone into exile in upper Egypt when the king came to the throne, since he had been an open advocate of the succession of Ptolemy Ceraunus, the brother of the king.

But despite the lack of historical evidence in support of the origin of the *Septuagint*, there is little doubt that a translation existed at an early date of the *Pentateuch*, the first five books, and this could very well have been made during the reign of Philadelphus. The account given by Aristobulus, who may have lived during the period of the second Ptolemy, but more probably during the reign of Ptolemy Philometor at the end of the second century, gives an account of the origin of the *Septuagint*, which agrees with that of the *Letter*. There is evidence also at a later date that an annual festival was held on Pharos in celebration of the translation.

But whatever may be the truth about the origin of the *Septuagint*, the effect of it upon subsequent history is a matter of common knowledge. For the Jewish laws, in their Greek translation, mingled with the stream of Hellenistic culture and at a later date exerted profound influence upon the development of the Christian church in Alexandria. Through Aristobulus, among others, the significance of the *Septuagint* was transmitted to Philo, the greatest of the Jewish philosophers of the classical period, who flourished in Alexandria around the beginning of the Christian era. Philo, whose story we shall tell in greater detail later, was a student of both the Jewish scriptures and the philosophy of Plato. He saw in these divergent streams of speculative thought a common origin, and devoted himself to the higher eclecticism of reconciling their respective doctrines.

The significance of this matter was not recognized in the time of Philadelphus, for the scholars in the Museum were busy with many other problems. The whole wide world had been opened to their vision, and the reign of Philadelphus was conspicuous more for its scientific and literary attainments than for its philosophy. But the latter was to

play its part in later centuries, when the troubles of a weary world had turned men's thoughts from the knowledge of science to the succors of religion.

The reign of Ptolemy II was singularly free from wars of consequence. One rebellion was started by his step-brother, Magas, governor of Cyrene, who asserted his independence from Egypt, and for a while, with the help of Seleucus, threatened to invade Egypt. But Philadelphus managed to quiet this adventure, and amity was established by the betrothal of Berenice, the daughter of Magas, to Ptolemy, later known as Euergetes, the son of Philadelphus. In the Mediterranean, Antigonus, the king of Macedonia, challenged his naval supremacy by defeating him in an engagement near the island of Cos, but this victory was apparently of small moment.

The life and reign of Philadelphus thus assumes the character of one that most men desire, a time of peace and prosperity. Let us honor it by remembering that for all the time to come the glories of the matchless Museum will overshadow the minor bickerings and the petty evils of one of the most beneficent monarchs who ever lived.

5. *Ptolemy, the Benefactor.*

When Philadelphus died in the year 246 B. C. his son, Ptolemy III, better known as Euergetes I, that is to say, the Benefactor, was a man in the prime of life, somewhere around thirty-five years of age. Near the beginning of his reign he married Berenice, the daughter and successor of King Magas of Cyrenaica, who had died about 250 B. C. This young lady, to whom he had been betrothed for a number of years, as we have said before, was a person of much spirit. After the death of Magas, the mother of Berenice, either not favoring Ptolemy, or for other reasons, desired to secure a Macedonian prince for her daughter's consort. Thus it came about that Demetrius the Fair, a son of Demetrius, the Besieger, of Macedonia, came to the royal court at Cyrene. But this young man looked with more favor upon the mother, who was a Syrian princess and doubtless still of great beauty, than he did upon the daughter. This was a fatal error, for Berenice, with more courage than her years would warrant, caused Demetrius to be slain in the chamber of her mother.¹

¹ Justin, xxvi, 3.

The marriage of Ptolemy and Berenice had not long been solemnized when the distressing news arrived from Syria that his sister, also named Berenice, and her infant son had been put to death by Laodice. Berenice, it would appear, had been a favorite daughter of Ptolemy Philadelphus and probably much petted by him. When Antiochus II of Syria had divorced his first wife, Laodice, and had married the daughter of Ptolemy, her father had been so thoughtful of her comfort that he had sent with her water from the Nile so that she should drink from this river only.¹

But Laodice, the divorced wife of Antiochus, was a woman full of dark plots and stratagems, cruel and merciless to those who stood in the way of her ambitions. Thus the story is told that once she plotted to kill Sophon, who was commander of Ephesus, and associated with herself in the scheme a friend Danae. But Danae, who had at one time been the mistress of Sophon, warned the commander and was detected by the queen. Whereupon Laodice took Danae to the top of a high precipice and ordered that she should be hurled to her death from it. With her last words the unlucky Danae complained bitterly to the gods. "I saved him who was once my lover," she cried, "and yet I receive death as my reward. Whereas the queen, after slaying her own husband, is thought worthy of great honor."²

When Antiochus died, probably by poison, poor Berenice and her son received no mercy from this tiger woman. For Laodice killed them both and claimed the kingdom for her son, who thus mounted the throne of Syria as Seleucus II. This violent act called for immediate vengeance, and Ptolemy prepared both his fleet and his army for the invasion of Syria.

6. *The Hair of Berenice.*

Then, indeed, was Berenice, his bride, disconsolate to be torn from her beloved husband so soon after their marriage. In order to propitiate the gods and to assure his return to her, Berenice promised to cut off a lock of her hair and to place it in the temple of Arsinoe Aphrodite at Zephyrium. This sacrifice was duly made, but in some mysterious manner the tresses disappeared from the temple of the goddess. Thereupon Conon, the astronomer of the Museum, came to

¹ Athenaeus: ii, 45.

² Athenaeus: xiii, 593.

the rescue, and immortalized the incident by informing the king and queen that the stolen locks had been transported to the sky. He pointed out to them that there, indeed, was the hair in the delicate network of stars which lies within the area formed by Ursa Major, Boötes, Virgo, and Leo. And to this very day that constellation is known as the *Hair of Berenice* (*Coma Berenices*).

This interesting matter struck the fancy of the Alexandrians and the poets of the Museum seized upon the incident as a promising topic for their labors. No less a man than Callimachus, himself, wrote a poem to the stolen tresses. Although the original, except for a few fragments, has disappeared, a translation was made by the Roman poet Catullus (87-54 B. C.), and this has come down to us. The poem, which is a soliloquy by the hair, may be of sufficient interest to the reader to warrant a few excerpts from it:

“Conon, who hath investigated all the lights in the great firmament, who hath ascertained the rising and the setting of the stars, and knows how the splendor of the rapid sun is obscured, how the stars depart at certain times, and how sweet love, detaining Diana among the crags of Latmos, withdraws her from her airy circuit; that same Conon saw, shining brilliantly with celestial light, me, the hair of Berenice’s head, which she, outstretching her smooth arms, had promised to many gods, at the time, when the king, recently blest in marriage, had gone to lay waste the Assyrian territory...

“Unwillingly, O queen, did I quit thy crown; unwillingly, I swear by thee and thy head; and fit chastisement befall whoever takes that oath lightly! And who can hope to withstand steel? That mountain too was cut down with steel, over which, the largest on the coasts, the illustrious race of Thia [the Macedonians] was borne, when the Medes swept through a new sea, and the barbarian youth navigated through the midst of Athos. What can hairs do when such things yield to steel? Perish, O Jupiter, the whole race of the Chalybes, and whoever in the beginning instituted the practice of seeking out veins under ground and forging hard steel.

“My sister hairs, just before they were separated from me, were bewailing my fate, when Ethiopian Memnon’s brother, the winged steed of Chloris, beating the air with quivering wings, presented himself in Arsinoë’s temple, and catching me up, flew through the dusky ether and laid me in the chaste sky. Zephyritis herself had sent her

servant to the pleasant regions of the Canopian shores, to the end that not only the golden crown of Ariadne's temples should be fixed in the varied extent of heaven, but that we, the consecrated spoils of Berenice's golden head, might shine there too. As moist with tears I entered the temple of the gods, divine Venus placed me as a new constellation among the ancient ones. For contiguous to the stars of the Virgin and of the fierce Lion, adjoining Callisto, the daughter of Lycaon, I turn to the west, preceding the slow Boötes, who sinks late and reluctantly into the deep ocean. But though footsteps of the gods press me by night [that is, along the Milky Way], yet by day I am restored to the bosom of the white-haired Tethys...

"Why do the stars hold me? Would I might again become the hair of my royal mistress! Orion might then shine next to Aquarius for aught I cared."

This sacrifice of her tresses made by Berenice apparently propitiated the gods, for Euergetes was more successful in his campaign than any ruler of Egypt before or after him. Although the records of his achievements are hazy and conjectural, he seems to have swept aside all resistance by the force of his fleet and the strength of his army; for we learn that he soon occupied the city of Antioch. This city enters into our record now for the first time, since it was founded only a few years after Alexandria (c. 300 B. C.) by Seleucus Nicator, after he had secured his grip on western Asia by the battle of Ipsus.

Called by Athanaeus "the beautiful city," Antioch was destined to rival Alexandria in magnificence. It was built on the western bank of the Orontes river in northern Syria, about twenty miles from the sea. Constructed along lines similar to those of the golden city, the two principal thoroughfares of Antioch intersected at right angles and these broad avenues were adorned with a series of colonnades. The citadel was built upon Mount Silpius, but the main city was on lower ground to the north along the river. One stream, known as Onopniktes [the donkey-drowner], flowed through the city, while others meandered through the beautiful Paradise of Daphne some four miles to the west. This famous spot was a tract of woods and gardens, in which had been erected by the city's founder a magnificent temple to Apollo.

After the capture of Antioch, Euergetes pressed eastward into Asia. Crossing finally the Euphrates river, he proceeded southward

at least to Babylon and Susa. From an ancient Greek inscription found at Adule on the African coast of the Red Sea, we learn that the king actually conquered the country as far west as Bactria and "having searched out all the things belonging to the gods which the Persians had carried away from Egypt, he took them back with other treasure to Egypt."

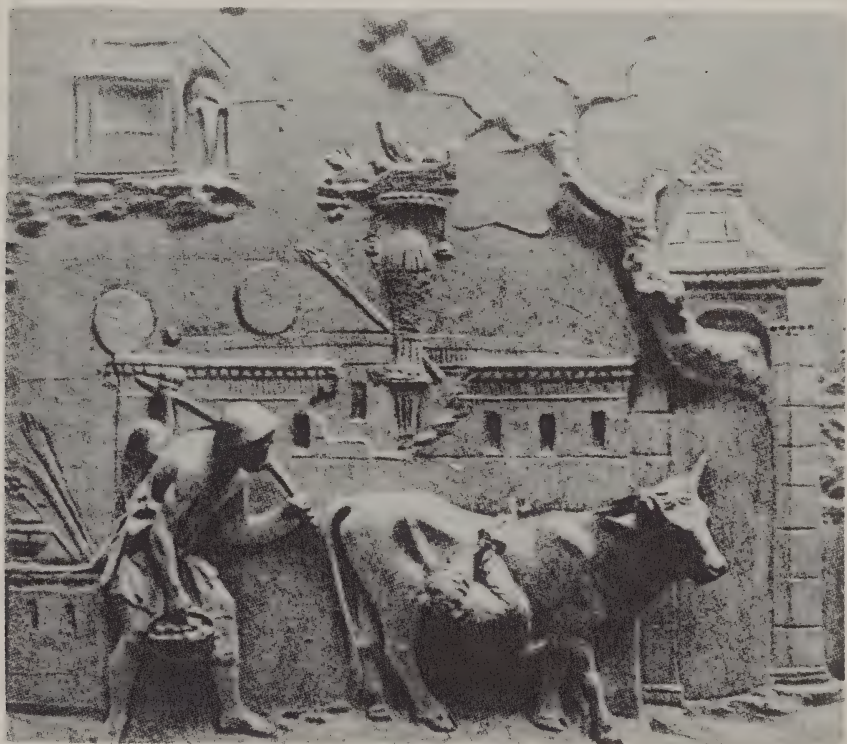
But the main object of the invasion, to wreak personal vengeance upon Seleucus and his mother, was not achieved; for the murderess and her son fled before the army of the king and were not taken. Astonishing enough, however, was this conquest of Asia. But apparently Euergetes finally became tired of the expedition, and after a lapse of three years, he turned his face toward Alexandria again. Although history is strangely silent about this interesting conquest and the adventures of the king, the records which we have would seem to indicate that during the reign of Euergetes the influence of the Ptolemaic dynasty reached its highest point. So great, indeed, became the reputation of the king, and so extensive his control of the waters of the eastern Mediterranean, that Aratus, dominating spirit of the famous Achæan League, shortly after his capture of the city of Corinth, appointed the Egyptian king as generalissimo of the League by land and sea.

7. The Achievement of Ptolemy, the Benefactor.

No further wars were undertaken by Euergetes after his return to Alexandria, but he now busied himself with the affairs of his own kingdom. His attention was directed toward the work of the Museum, and his clear insight into the significance of this monument to learning is attested by the fact that he recalled the great scholar Eratosthenes from Athens to tutor the crown prince and to serve as the chief librarian. About the work of this intellectual leader we shall have much to say in another place. Other men of learning were attracted also to the Museum, and the tradition of royal patronage to the arts and sciences, which had been inaugurated by Ptolemy Soter, and expanded by Philadelphus, was continued during the reign of Euergetes.

The king also busied himself with the building and the repair of temples throughout Egypt. The magnificence of these efforts is attested by the remains of the temple at Edfu, which was completed

by his successor, and those of the temple to Isis at Philae, which had been started by his father. The former was of vast size. The walls enclosed an area approximately an acre and a quarter in extent. The outer gateway, or propylon, was 252 feet from side to side, and the towers were 112 feet in height.



A RURAL SCENE in a relief which might have been inspired by the idyls of Theocritus. The peasant on his way to market with his cow and chickens is a fine example of the art that must have flourished in Alexandria.

So diligent was Euergetes in this work of building and reconstruction that in 238 B. C. the priests held a conclave in Canopus and bestowed special honors upon the king and queen. A copy of this famous decree has come down to us, written not only in Greek, but in demotic and hieroglyphic characters as well. In it the king is honored for having restored the sacred statues from Persia, and for

having taken care of the people of Egypt when famine came upon them from the failure of the inundation of the Nile. While the priests were thus assembled, they received news of the death of the princess Berenice, daughter of the king and queen. This was made the occasion for special mourning throughout the land, and the decree thus issued conferred unusual honors upon her. Statues of the princess, wrought in gold and set with gems, were ordered placed in all the major temples. At harvest time ears of corn were to be offered to her memory, and loaves of bread were to be made of special shape and called "the bread of Berenices."

During the reign of Euergetes there occurred the violent earthquake in Rhodes which was referred to in the first chapter. This disastrous prodigy destroyed the colossus of Helios, together with the shipyards, the walls, and many of the buildings in the city. The Egyptian king came magnificently to the aid of the stricken Rhodians. Besides furnishing them with great quantities of corn, he gave them substantial sums of money as well. Although a large number of workmen were sent along to repair the colossus, this statue was never raised again.

Finally, in the year 222 B. C., after a prosperous reign of nearly a quarter of a century, the good king died. Alexandria was at the height of its prosperity, and its citizens avowed that this Ptolemy had been well named, the Benefactor.

8. *The King of Evil.*

When Euergetes died in 222 B. C. the Ptolemies had ruled Egypt for exactly a century, and each of the three kings had left Alexandria more prosperous than it had been at the beginning of their reigns. Commerce had thrived; public buildings had been erected; the arts had flourished under their beneficent regimes. But with the accession of Ptolemy Philopator to the throne of his father the picture darkens; for now the scepter is in the hands of a monster of sloth and wickedness. In him we find the first evidence of that deterioration which may be expected in the progeny of parents too closely related to one another. This inevitable genetic decadence became even more marked in the history of his successors. And a blight began to fall upon the dynasty of the Ptolemies.

This evil king inaugurated his reign by slaying his brother Magas, then his uncle Lysimachus, and finally his mother Berenice. He was given to the practice of all kinds of evil excesses. Indolence and debauchery became the habits of his life to such an extent that the affairs of the kingdom were left almost entirely in the hands of his ministers. The most influential of these was Sosibius, a wily character of devious ways and uncertain morals, and Agathocles, an odious adventurer, whose equally evil sister, Agathocleia, became the mistress of the king. These ministers were hated by the people, but they were supported by Philopator, for he liked their ways, and they maintained their power to the last. Sosibius, in particular, to give the devil his due, had a natural cunning suited to the diplomacy of that day, and he was able to keep the government in successful operation while the king played.

An incident near the beginning of the reign illustrates both the character of the king and the nature of Sosibius. It appears that Cleomenes, the young and valiant king of Sparta, had come to Alexandria with a few of his friends late in the reign of Euergetes to obtain backing for an attempt to raise Greece against the Macedonian yoke. He was a young man of vigorous leadership and high social ideals. But when Philopator came to the throne this energetic spirit became something of a thorn in his flesh. Cleomenes, chafing at the indolence of the king and his own forced idling about the city, expressed too freely his opinion of the ruler. On one occasion, when Nicagoras, a man who deeply hated Cleomenes, and yet pretended to be his friend, arrived in Alexandria with some war horses for Ptolemy, the Spartan king said to him: "I could wish you had rather brought young boys and music girls; for these are now the king's chief occupation."¹

These words reached the ears of Sosibius, who thereupon persuaded Nicagoras to write a letter accusing Cleomenes of a plot to seize Cyrene. When this letter was shown to Philopator he was much incensed. But not wishing to attack Cleomenes directly because of his following, he told his minister to invite the Spartan and his friends to one of the palaces. There they were to be entertained, but were not to be allowed to go out again. From this gilded cage, Cleomenes

¹ Plutarch: *Cleomenes*.

and his companions finally broke loose, and by rioting in the streets of Alexandria, attempted to rouse the citizens to fight for their liberties against the king and his detested ministers. The effort was abortive. The Alexandrians retired into their houses in fear of the consequences. After further rioting, in which one attempt was made to free some of the prisoners housed in the city, the Spartans saw at last that there was no hope for them or their cause. Thereupon, rather than to be taken prisoners again, they fell upon their swords and died.

The neglect of the affairs of government by Philopator finally invited genuine trouble. Antiochus III, afterwards called Antiochus the Great, ruler of the Seleucid empire, saw in the indolence of the Egyptian king an opportunity to regain part of the territory, which had been seized by Euergetes during his invasion of Syria and eastern Asia. He first attacked and captured the city of Seleukeia at the mouth of the Orontes, which had been held by the Egyptians since 246 B. C. His next victory gave him control of Coele-Syria. This was turned over to him by the governor Theodotus, who had become thoroughly disgusted with the debauchery of Ptolemy and his neglect of every duty. Theodotus was also deeply incensed at Sosibius, through whose machinations he had been deprived of all reward in his preliminary services against Antiochus, and had almost lost his life when he had been summoned to Alexandria.

Aroused at length by the pressing dangers of invasion, Philopator gathered a force at Pelusium, and filled up the wells in the neighborhood by cutting the dikes in the river. But at this time Egypt was in no position to repel an invasion, so the wily Sosibius, aided by Agathocles, sought a delay by asking for a conference over the matter from Antiochus. This was granted and for a year the ambassadors wrangled over the problems at Seleukeia. During this period the Egyptian ministers busied themselves in the preparation of arms and in the assembling and training of an adequate army. This delay was fatal to the plans of Antiochus, for when negotiations were finally broken off and the rival forces faced one another near the village of Raphia on the border between Egypt and Syria, the Egyptians were represented by a formidable body of troops.

While the two armies were thus encamped near one another there occurred one of those events which so often add a tang to the military

episodes of years ago. For Theodotus, the governor of Syria who had come to hate Philopator with such bitterness, resolved upon a dangerous adventure. Since he had lived formerly at the court in Alexandria he knew the tastes and habits of the king. Equipped with this knowledge and accompanied by two companions, he boldly entered the Egyptian camp a short time before dawn. Relying upon the fact that there was a great variety of dress in the army, since it had been recruited from many places, and hence their own garments would not betray them, Theodotus advanced unhesitatingly to the king's tent. In the darkness before the dawn his face was not recognized and he passed unchallenged by the guards stationed near the tent. Entering this boldly, Theodotus then made a hasty search for the person of Philopator, but did not find him, since the king by chance had slept that night in another place. The intruders, however, must have caused some commotion in this search, for they wounded two men, who were sleeping in the tent, and killed Andreas, the physician to the king. But even these encounters did not sufficiently arouse the guards to the danger which threatened the king, for the bold Theodotus and his companions escaped and returned unscathed to their own camp.

For five days the armies faced each other in the Syrian plains. But finally a decision was demanded and the two forces were drawn up in battle array with King Ptolemy, accompanied by his young sister Arsinoe, on the left wing of the army, and Antiochus, with his royal guard, on the right wing. Suddenly the trumpets blared, and the battle opened with a charge of elephants. This struggle is graphically told by Polybius in the following words:¹

“The way in which these animals fight is as follows: With their tusks firmly interlocked they shove with all their might, each trying to force the other to give ground, until the one who proves strongest pushes aside the other's trunk, and then, when he has once made him turn and has him in the flank, he gores him with his tusks as a bull does with his horns. Most of Ptolemy's elephants, however, declined the combat, as is the habit of African elephants; for unable to stand the smell and the trumpeting of the Indian elephants, and terrified, I suppose, also by their great size and strength, they at once turn tail and take to flight before they get near them.

¹ v, 84.

“This is what happened on the present occasion; and when Ptolemy’s elephants were thus thrown into confusion and driven back on their own lines, Ptolemy’s guard gave way under the pressure of the animals. Meanwhile Antiochus and his cavalry, riding past the flank of the elephants on the outside, attacked Polycrates and the cavalry under his command; while at the same time on the other side of the elephants the Greek mercenaries next the phalanx fell upon Ptolemy’s peltasts and drove them back, their ranks having been already thrown into confusion by the elephants. Thus the whole of Ptolemy’s left wing was hard pressed and in retreat.”

In spite of this unsuccessful outcome of the charge of the elephants, however, the troops of Ptolemy soon rallied, and by a successful use of the deadly phalanx, finally routed the troops of Antiochus. The victory was decisive. The fortunate outcome of this struggle thus awarded the control of Coele-Syria to the dynasty of the Ptolemies for another period.

There was, however, one unfortunate aspect to this contest. For the native Egyptians had been armed to repel the invader and these soldiers, for the first time, tasted the fruits of victory. No longer were they content to eat the scrapings from the table of the king, and some time after the battle of Raphia they rose in rebellion. The details of this struggle have not come down to us.

9. *Ptolemy as a Ship-BUILDER.*

In spite of the many evils attributed to Philopator, the king had one hobby that was both constructive and important. This was his interest in the building of large and luxurious ships. A description of two of these has been given to us in quotations by Athenaeus¹ from the work of Callixeinus *On Alexandria*.

The first of these remarkable vessels was a “forty-bank [war] ship with a length of four hundred and twenty-five feet; its beam from gangway to gangway was fifty-seven feet; its height to the gunwale was seventy-two feet. From the top of the stern-post to the water-line it measured seventy-nine and a half feet. It had four steering-oars forty-five feet long, and the oars of the topmost rowers, which are the longest, measured fifty-seven feet; these, since they carried lead on the handles and were very heavy inboard, were yet easy to manage

¹ v, 203-206.

in actual use because of their nice balance. It had a double bow and a double stern, and carried seven rams; one of these was the leader, others were of gradually declining size, some being mounted on catheads."

This astonishing ship required more than four thousand men to man the oars, and an additional crew of four hundred to manage the sails and the rigging. For fighting purposes, the vessel was large enough to accomodate a force of two thousand, eight hundred and fifty marines. When we reflect that the largest ships built in modern times, such as the *Normandie* and the *Queen Mary*, are only a little more than twice as long and twice as wide as this leviathan of the navy of Philopator, then, indeed, do we have some appreciation of the remarkable technical skill which existed in that early day of the golden city.

The launching of such a ship presented naturally a great problem. It was accomplished in the following manner:¹

"At the beginning it was launched from a kind of cradle, they say, which was put together from timbers of fifty five-bank ships, and it was pulled into the water by a crowd to the accompaniment of shouts and trumpets. Later, however, a Phoenician conceived the method of launching by digging a trench under the ship near the harbor equal in length to the ship. He constructed for this trench foundations of solid stone seven and a half feet in depth, and from one end of these foundations to the other he fixed in a row of skids, which ran transversely to the stones across the width of the trench, leaving a space below them six feet deep. And having dug a sluice from the sea, he let the sea into all the excavated space, filling it full; into this space he easily brought the vessel, with the help of unskilled men. When they had barred the entrance which had been opened at the beginning, they again pumped out the sea water with engines. And when this had been done, the ship rested securely on the skids mentioned above."

The second vessel of Philopator was in many ways more remarkable than his warship. This was a river boat intended to be used as a barge of state. It had a length of three hundred feet and was forty-five feet across the beam at its widest place. From Athenaeus we have the following description of this unusual vessel:²

¹ *Athenaeus*, v, 204.

² v, 204.

"Its shape was neither like that of the war galleys nor like that of the round-bottomed merchantmen, but it had been altered somewhat in draught to suit its use on the river. For below the water-line it was flat and broad, but in its bulk it rose high in the air; and the top parts of its sides, especially near the bow, extended in a considerable overhang, with a backward curve very graceful in appearance. It had a double bow and a double stern which projected upward to a high point, because the waves in the river often rise very high.

"The hold amidships was constructed with saloons for dinner parties, with berths, and all the other conveniences of living. Around the ship, on three sides, ran double promenades. The perimeter of one of these measured not less than five furlongs. The structure of the one below decks resembled a peristyle; that of the one on the upper deck was like a concealed peristyle built up all around with walls and windows. As one first came on board at the stern, there was set a vestibule open in front, but having a row of columns on the sides; in the part which faced the bow was built a fore-gate, constructed of ivory and the most expensive wood. Entering this, one came upon a kind of proscenium, which in its construction had been roofed over. Matching the fore-gate, again, a second vestibule lay aft at the transverse side, and a portal with four doors led into it.

"On both sides, left and right, portholes were set beneath to provide good ventilation. Connected with these entrances was the largest cabin. It had a single row of columns all around and could hold twenty couches. The most of it was made of split cedar and Milesian cypress; the surrounding doors, twenty in number, had panels of fragrant cedar nicely glued together, with ornamentation in ivory. The decorative studs covering their surface, and the handles as well, were made of red copper, which had been gilded in the fire. As for the columns, their shafts were made of cypress-wood, while the capitals, of the Corinthian order, were entirely covered with ivory and gold. The whole entablature was in gold. Over it was fastened a frieze with striking figures in ivory, more than a foot and a half tall, mediocre in workmanship, to be sure, but remarkable in their lavish display.

"Over the dining saloon was a beautiful coffered ceiling of cypress-wood; the ornamentations on it were sculptured, with a surface of gilt. Next to this dining-saloon was a sleeping apartment with seven berths, adjoining which was a narrow passage-way running transversely from one side of the hold to the other, and dividing off the women's quarters. In the latter was a dining-saloon with nine

couches, which was similar to the large saloon in magnificence, and a sleeping apartment with five berths."

It is astonishing, indeed, to see in that remote time the same luxury which we associate with modern modes of travel in our great ocean liners of the present day. If one still needs to be convinced that the golden age of Alexandria reached heights not much below those of golden ages nearer our own times, let him imagine the comfort with which he might have traveled up the broad Nile in this river boat of the Egyptian Ptolemy.

10. *The Dreadful End of Agathocles.*

By the year 204 B. C. the dissolute life of Philopator began to take its toll. Surrounded by the members of his wretched court, attended by the corrupt Sosibius, the evil Agathocles, and his sister Agathocleia, the dissolute king, after a reign of seventeen years, finally breathed his last.

Dramatic events now accompanied the succession to the throne of Philopator's son, a lad about five years of age, who was to be known as Ptolemy Epiphanes, that is to say, the Illustrious. For as soon as Philopator was dead, Sosibius and Agathocles erected a platform in the largest colonnade of the palace, and summoning the members of the household, the royal guard, and certain officers of the army, they announced that not only was the king dead, but that his wife, the Queen Arsinoe, had also passed away. They then presented young Ptolemy as the rightful successor to the throne and read a forged will in which his person was committed to the two ministers as guardians.

This announcement created a tremendous sensation when it reached the ears of the people, not because of the death of the king, for nobody cared about this, says Polybius, our authority,¹ but because of the death of the queen concerning which ugly rumors had apparently been circulated. What the circumstances were we do not know since the record of Polybius is lost at this interesting place. But that she had been murdered a short while before by a certain Philamon with the connivance of the ministers is told to us. At the announcement of the death of the queen "the people fell into such a state of dis-

¹ *History*. xv, 25.

traction and affliction that the city was full of groans, tears, and ceaseless lamentation, a testimony, in the opinion of those who judged correctly, not so much of affection for Arsinoe as of hatred of Agathocles."

As soon as these services were over and the urns with the ashes of the king and queen had been deposited in the royal vaults, the ministers granted two months' pay to the troops and sent the murderer away to Cyrenaica. They entrusted the care of the young king to Oenante, the mother of Agathocles, and to his sister. But the passions of the people were not allayed by these acts and excitement continued to grow in the city. Agathocles then removed most of the important men from their royal trusts and appointed in their places "from the body of servants and other attendants those most remarkable for their effrontery and recklessness. He himself spent the greater part of the day and night in drinking and the debauchery which commonly accompanies it."

At first the people had no leader strong enough to oppose this trend of affairs, but soon their eyes turned to Tlepolemus, the military governor of the district around Pelusium. At first the governor was inclined to remain aloof from the situation, but when it became clear that the intentions of Agathocles were to keep the reins of the government in his own hands, he saw that action on his part was necessary. Thereupon he entertained in a lavish manner many of the leading men in Alexandria, and in the course of these banquets, at first cautiously, but soon with more boldness, threw jibes at the profligacy of Agathocles and his court.

At length matters reached the critical stage and Agathocles, observing the growing dissatisfaction, summoned a meeting of the Macedonian soldiers and appeared before them with his sister Agathoclea and the young king.

"At first," says Polybius, "he pretended that he could not say what he wished owing to the abundance of the tears that choked him, but after wiping his eyes many times with his chlamys and subduing the outburst, he took the child in his arms and exclaimed, 'Take the child whom his father on his death-bed placed in the arms of this woman,' pointing to his sister, 'and confide to your faith, O men of Macedonia. Her affection indeed is of but little moment to ensure his

safety, but his fate depends upon you and your valor. For it has long been evident to those who judge correctly that Ptolemy aspires to a position higher than it behoves him to covet, and now he has actually fixed the day and the hour at which he will assume the prerogatives of state.'"

But the soldiers at this appeal, recognizing its insincerity, showed their feelings by hoots and cat-calls, and Agathocles retired in confusion from the meeting. The feelings of the populace were further inflamed at this juncture when the ministers took Danae, the mother-in-law of Ptolemy, from the temple of Demeter "and dragged her unveiled through the middle of the city and committed her to prison."

The crisis was precipitated by a curious incident. In his agitation Agathocles began to meditate flight, but since this seemed out of the question, he turned to persecution. Having been informed that Moeragenes, one of the king's bodyguards, was giving information to Ptolemy, the minister ordered the arrest of the unfortunate man and instructed Nicostratus, his secretary of state, to subject him to torture. When he had been stripped of his clothes, and stood in terror before the instruments and the men assigned to wield the scourges, suddenly a messenger appeared and whispered something to Nicostratus. Whereupon the secretary of state left the torture chamber without a word. For a while the guards remained in great indecision, but finally dispersed leaving Moeragenes alone. This astonished gentleman without a moment's hesitation took to his heels. Rushing naked through the palace and into the tents of the Macedonians who were camped close at hand, he burst in upon them to tell his story. When they finally believed him, the Macedonians decided to lead the revolt against the government.

At this critical moment, Oenante, the mother of Agathocles, went in great distress to one of the temples, and began to pray fervently to the goddesses. Whereupon some of her friends came to her to console the distraught lady. But in her frenzy of apprehension she drove them away, shouting: "I know well that you bear us ill-will and that you pray to the goddesses that the worst may befall us. But yet I trust that, if it be the will of heaven, I shall make you taste the flesh of your children."

These savage words immediately aroused fiery anger in the breasts

of all the women who heard them, and they hastened home to tell the news to their husbands. And so it came about that there was formed the first Alexandrian mob of which we have historical record. Since these scenes of violence became very common in later days, it is worth our while to view this one through the eyes of Polybius:

“The men had already decided on revolution, but now that in each house the rage of the women was added to their own, the hatred of the usurper blazed up twice as violently. When day gave place to night, the whole city was full of disturbance and torches and movement. Some shouting collected in the stadium; some encouraged one another; others running in different directions took refuge in houses and places not likely to be suspected. The open spaces around the palace, the stadium, and the great square were now filled by a mixed multitude, including all the crowd of extra performers in the theater of Dionysius.

“And Agathocles, when he heard what was occurring, aroused himself from his drunken slumber, having broken up the banquet a short time previously, and taking all his relatives except Philo [either his brother or step-brother] went to the king. After lamenting his ill-fortune to the boy in a few words he took him by the hand and went up to the gallery between the Maeander and the Palaestra leading to the theater. After having made fast the first two doors, he retired to the third with a few of the bodyguard, the king, and his own relatives. The doors were of open lattice-work through which one could see, and they were each secured by two bolts. Meanwhile the populace was assembling from every part of the city, so that not only level spaces but the roofs and the steps were full of people; and there was a confused uproar and clamor, women and children being mixed with the men. For in Carthage and also in Alexandria the children play no less a part in such tumults than the men.”

The Macedonian guards now burst into the palace and soon found out where Agathocles and the king were hidden. Thereupon there was a parley in which Agathocles begged for his life and offered to return the king to the people if this were granted. At first no one would carry this message to the soldiers, but finally Aristomenes, who had once been a close friend of Agathocles, offered to present the proposition. He was nearly slain for his pains, and was told sternly to return and bring the king, or else he would, indeed, forfeit his life. When this message was given to Agathocles he made a piteous appeal for mercy,

thrusting his hands through the lattice work of the door and "Agathocleia her breasts with which she said she had suckled the king."

These appeals were of no avail, and finally Agathocles released the king who was immediately placed on a horse and conducted to the stadium. Then did the people rejoice and their cries rang to the skies. But their joy was tempered by the fact that their persecutors still remained unpunished. When their shouting then turned to cries of vengeance, Sosibius, the son of the minister, asked the king whether he was willing to give up the people who had done so much evil to himself and his mother. And when the poor child, scarcely knowing what the excitement was all about, nodded his assent, the people burst into loud cries and a guard was dispatched to communicate the royal decision.

The violence of the mob was precipitated when Philo happened to come out upon the street in an intoxicated condition. Observing the excitement he commenced to boast about what Agathocles would do if he came out against the crowd. Hearing this, the people started to hustle the unfortunate Philo, shoving him this way and that, and when he tried to defend himself they tore off his coat, and finally ran him through with a spear. When he was at last dragged still breathing into the stadium, the excitement reached fever heat for the mob had now tasted blood. The wretched Agathocles was soon brought into the stadium in chains, and with cries of rage the people rushed upon him and stabbed him. Next came Nico, a relative, and Agathocleia stripped naked with her sisters. And then the unfortunate Oenanthe, mounted on a horse. "All of them were delivered into the hands of the mob, and now some began to bite them with their teeth, some to stab them, and others to dig out their eyes. Whenever one of them fell they tore the body limb from limb until they had mutilated them all. For terrible is the cruelty of the Egyptians when their anger is aroused."

The fate of the minister Sosibius is not revealed by Polybius, but he apparently had died before these last events took place. His son, as we have seen, evidently held a position of authority in the government. Philamon, the murderer of the queen, took this inopportune moment to return to Alexandria and he and his family were slain. Tlepolemus became the prime minister of Egypt, a post which he finally relinquished to the more capable hands of Aristomenes.

11. *The Reign of Epiphanes*

The reign of Epiphanes, so inauspiciously begun, was marked neither by conspicuous success nor unusual failure. The first event of consequence was the result of an infamous pact made by Philip V of Macedonia and Antiochus III of Syria to partition the Egyptian empire. The defense of Coele-Syria was entrusted to Skopas, the Aetolian general, a man more interested in personal gain than in military glory, and he was finally defeated in the battle of Panium (198 B. C.). Because Skopas was believed to be plotting against the government, he was executed shortly after this event.

Since Philip was also carrying out a successful campaign against some of the island possessions of Egypt, Aristomenes appealed to the Roman government for aid against this unwarranted aggression. The result of this appeal was to halt abruptly the depredations of the two partitioners, and at least some of the lost revenue was returned to Egypt when Antiochus gave his daughter Cleopatra in marriage to Epiphanes in 193 B. C. The Syrian princess brought as a dowry half of the taxes of the conquered territory.

In 196 B. C. Epiphanes was officially proclaimed king. This event was celebrated by the Egyptian priesthood assembled at Memphis, who issued a proclamation in favor of the king in which they recounted his numerous benefits to the country. This document has come down to us engraved upon the famous *Rosetta Stone*. Written not only in Greek, but also in hieroglyphic and demotic characters, this basalt tablet in the hands of the celebrated French Egyptologist Jean François Champollion (1790-1832) proved to be the key which has deciphered the ancient monuments of Egypt.

About the personal character of the king we know very little. He seems to have inherited some of the bad characteristics of his father and apparently combined with natural indolence a cruel nature, which was shown in his savage treatment of certain nobles who had revolted at Lycopolis in 186 B. C. However, we are told that the king was fond of hunting and excelled in athletic games, which might refute the reputation given him of indolence.

At last, after a reign of some twenty-two years, Epiphanes died in

182 B. C., some say by poison. He left at least two sons, and probably three, to quarrel over the succession, and a daughter named Cleopatra.

12. *The Confused Succession.*

To Ptolemy VI we give a scanty line for nothing at all is known about him except that, from the evidence of a few inscriptions, he is believed to have been associated in the throne while his father was alive, and even received the title of Eupator [Well born]. Since time may finally give us other details of this shadowy figure, we can do no more than assign a number to him, and pass on to his brother Philometor.

This king, Ptolemy VII, known as Philometor, ascended the throne at the age of seven years and ruled under the regency of his mother, the Syrian princess, Cleopatra. During the lifetime of this able queen, Egypt remained prosperous and at peace, but upon her death the inevitable dispute arose again over the rule of Coele-Syria. This country had returned to the Egyptian crown as the dowry of the queen, as we have already said, but as soon as she was dead Antiochus IV made use of the occasion to seize the throne. Then there was once more the rattle of arms in Egypt, for Philometor decided to contest the occupation. But the decision proved to be a disastrous one, since Antiochus first routed the army of the inexperienced king, who was then not more than sixteen years of age, and marching on Memphis, proclaimed himself the King of Egypt. An important trump now fell into the hands of the invader. For at this low ebb in his fortunes, Philometor decided to leave Egypt and fled by sea toward a harborage in Samothrace. Unfortunately his boat was intercepted, and the poor king was brought back to Memphis. Then, indeed, the rule of the Ptolemies in Egypt seemed very near its end.

But at this critical juncture a new element entered the picture. Egypt could not be conquered until Alexandria fell; and Cleopatra, the wife and sister of the king, was a young woman of spirit. She immediately roused the Alexandrians to their danger, and persuaded her younger brother, also named Ptolemy, to lead the citizens in their defense of the city. With Philometor in the hands of the enemy, this young man seized the confusion of the moment to declare himself the

king of Egypt. So here we see the beginnings of a drama, where poor Egypt suddenly found herself with three kings at one time, where one was bad enough.

But the Alexandrians rallied around Cleopatra and her brother. When Antiochus saw that he could not take the city easily, he withdrew into Syria leaving Philometor as his viceroy in Memphis. Doubtless he hoped that civil war would now do for him what his arms had failed to accomplish.

13. *Ptolemy, the Sausage.*

The new king of Egypt was later to be known as Ptolemy IX, and we may pause a moment to make his acquaintance. For he is one that is of interest to the world, not for his goodness, but rather for the intensity of his evil character. Sardonicly he assumed the surname of *Euergetes* II, that is to say, the *Benefactor*; but because of his excesses and his great cruelty he was called by the Alexandrians, *Kakergetes*, which means the *Malefactor*. History, however, more frequently refers to him as *Physkon*, that is to say, the *Sausage*, because of his excessive obesity and his dark and spotted complexion.

A graphic picture of *Physkon* is given by Athanaeus¹, who says:

“The Stoic Poseidonius . . . , who travelled with Scipio Africanus when he was invited to Alexandria and saw Ptolemy, writes in the seventh book of his *Histories*: ‘Through indulgence and luxury his body had become utterly corrupted with fat and with a belly of such a size that it would have been hard to measure it with one’s arms; to cover it he wore a tunic which reached to his feet and which had sleeves extending to his wrists; but he never went abroad on foot except [with the aid of a staff].’

“And that this king was not a stranger to luxury is attested by himself in the eighth book of his *Commentaries*, when he relates of himself how he became priest of Apollo in Cyrene, and prepared a banquet for those who had been priests before him; he writes as follows: ‘The Artemisia is a very important festival at Cyrene, at which the priest of Apollo (who is chosen annually) gives a dinner to those who have preceded him in that office, and places before each guest a bowl; this is an earthenware vessel capable of holding about 20

¹ xii, 549.

artebas [somewhat over 30 bushels], in which are placed many pieces of wild game, nicely cooked, sometimes also many domestic fowls, and several kinds of sea-fish and imported smoked fish; some persons often add the gift of a neat little foot-boy. But we abolished all that sort of thing, and procured *phialai* [goblets of solid silver], each alone having as great value as the entire outlay of things we have mentioned; moreover we added a horse, all caparisoned, along with a groom and bridle-ornaments inlaid with gold, and invited every guest on leaving for home to mount the horse and ride.'"

This unsavory king was also apparently as cruel as he was deformed, and he treated his Alexandrian subjects with wilful malice. Unmindful of the beneficent policies of his ancestors toward the arts and sciences, he appears to have turned against the scholars of the Museum and to have driven many of them into exile. But the loss to Alexandria by this persecution was gain to the rest of the world, for the knowledge of the scholars was thus transported throughout the Mediterranean countries, in a manner similar to that by which classical learning was disseminated throughout the world by the fall of Constantinople in the fifteenth century. About this important exodus we learn the following from Athenaeus, who says¹:

"You, indeed, are not aware that Meneclēs, the historian of Barca, and again Andon of Alexandria, in his *Chronicles*, record that the Alexandrians were the teachers of all Greeks and barbarians at a time when the entire system of general education had broken down by reason of the continually recurring disturbances which took place in the period of Alexander's successors... For [Ptolemy Physkon] murdered many of the Alexandrians; not a few he sent into exile, and filled the islands and towns with men who had grown up with his brother — philologists, philosophers, mathematicians, musicians, painters, athletic trainers, physicians, and many other men of skill in their profession. And so they, reduced by poverty to teaching what they knew, instructed many distinguished men."

14. *The War of the Brothers.*

As soon as the forces of Antiochus had been withdrawn from Memphis the two brothers were reconciled. But when the Syrian ruler

¹ iv, 184.

learned of this he immediately returned and doubtless would have completed his conquest of Egypt had it not been for the intervention of Rome. The authority which the Roman government exerted at this time in these quarrels between the nations in the eastern Mediterranean is well illustrated by this incident. The following account is given by Polybius¹:

“At the time when Antiochus approached Ptolemy and meant to occupy Pelusium, Caius Popilius Laenas, the Roman commander, when Antiochus greeted him from a distance and then held out his hand, presented to the king, as he had it with him, the tablet which contained the decree of the senate, and told him to read it first, not thinking it proper, as it seems to me, to make the conventional sign of friendship before he knew whether the intentions of him who was greeting him were friendly or hostile. But when the king, after reading it, said he would like to communicate with his friends about the document, Popilius acted in a manner which was thought to be offensive and exceedingly arrogant. He was carrying a stick cut from a vine, and with this he drew a circle about Antiochus, and told him that he must remain inside this area until he had given his decision about the contents of the letter. The king was astonished at this authoritative proceeding; but after a few moments of hesitation, he said that he would do all that the Roman demanded. Upon this Popilius and his suite grasped the king by the hand and greeted him warmly.”

In 170 B. C. the two brothers agreed to a joint regency. But the inevitable quarrel developed and in 163 B. C. Philometor fled to Rome for help. The envoys, sent to adjudicate the matter, immediately restored Philometor to the throne and awarded the crown of Cyrenaica to Physkon. But this arrangement did not appease the irascible Ptolemy, and in his turn he hastened to Rome to demand that the island of Cyprus should also be added to his domain.

Upon being sent to Cyprus to await a decision, he busied himself collecting an army to enforce his demands, but was compelled to employ these troops in putting down a rebellion in Cyrene. When the envoys finally arrived in Cyprus, they found Philometor in charge of the island with an impressive army at his back. Physkon was then besieged at Lapethus, a city of Cyprus, and in 155 B. C. he yielded

¹ xxix, 27.

to the forces of his brother. But Philometor proved to have a kindly and forgiving nature, most unusual in those savage times, for he not only gave full pardon to his brother but sent him back to Cyrene.

Then followed the inevitable clash of interests with the Seleucid empire in which Philometor played a conspicuous role. In 145 B. C. he was asked by the citizens of Antioch to accept the crown of these eastern domains, but he declined the hazardous honor and installed Demetrius II, his son-in-law, as the king instead. In the decisive battle of this succession, which was fought on the Oenoparas near Antioch that same year, Philometor received a mortal wound.

Although we do not have a clear account of the character of this Ptolemy, he seems to have been a man of kindly and upright principles. He forgave his brother his acts of treachery, and Alexandria prospered during his reign of twenty-six years.

No sooner had the death of Philometor been announced in the golden city than Cleopatra, the Queen, proclaimed her son, then a young child, as the successor of his father. Poor lad! No sooner had Physkon heard of this event than he swooped down like a hawk upon the dove-cot and, backed by an impressive army, claimed the throne. The battle was not fought, however, for the Roman envoys intervened and gave the crown to Physkon, thus terminating, before it had well begun, the reign of Ptolemy VIII, called in some accounts Eupator II, and in others Neos Philopator. By the terms of the agreement Physkon was to marry Cleopatra, his brother's widow, and his own sister. This union resulted in the birth of a son Memphites.

As soon as Physkon was well established on the throne he proceeded to get rid of all those who were unfriendly or dangerous to him. Naturally Ptolemy VIII was one of the first on this evil list, which, from all accounts, was a long one and included the names of many of the prominent citizens of Alexandria.

We shall not dwell on the deeds of this monstrous king. The character of his reign may be inferred from the fact that in 130 B. C. he was forced to flee to Cyprus to escape the wrath of his enraged subjects. He had taken with him his son Memphites. When the news was brought to him that the Alexandrians had chosen his sister-wife Cleopatra as his successor, his wicked mind was so inflamed that he murdered his son and sent his head as a birthday present to the queen.

But the administration of Cleopatra was not successful and finally she fled to the Syrian court leaving the kingdom to the mercy of her brother. After some minor bickerings with the Syrian domains, Ptolemy finally lapsed into a state of comparative quiet and passed the remainder of his days in an exercise of the debaucheries which he enjoyed. Strange to say he finally became reconciled during this period with his sister-wife and she returned to his court again in spite of the outrages which she had suffered. But we may well imagine that few tears were shed by her or by his subjects when this monster of evil finally breathed his last in the year 116 B. C.

15. *Reigns of the Later Ptolemies.*

When the will of Ptolemy was read it was found that the king had left Egypt and Cyprus jointly to Cleopatra, who was commonly known also by the name of Cocce (Scarlet), and to either of their sons Ptolemy (Soter II), or Ptolemy XI (Alexander I) as she should decide. Since Alexander was her favorite son she selected him, but when the people of Alexandria rejected this choice, she reluctantly accepted his brother on the condition that he would divorce his sister Cleopatra and marry his younger sister Selene. Alexander was then sent to rule Cyprus.

But now began as usual the quarrels of a joint administration. In 108 B. C. Cleopatra ousted Ptolemy X and recalled Alexander from Cyprus. Thereupon Ptolemy X took his brother's place as ruler of the island and held it against the forces sent by his mother. But in the meantime affairs did not progress too smoothly in Alexandria. In 101 B. C. Cleopatra finally died, some say at the hands of her son, who had discovered a plot against his life. Thereafter Alexander ruled alone until 88 B. C., when the Alexandrians revolted against his reign and he was driven from the throne. He appears to have fled with his wife and daughter, first to Lycia and then to Cyprus, where he was overtaken by an Egyptian army and slain.

Thereupon Ptolemy X was recalled to the throne and ruled uneventfully, as far as we know, for eight years. The only matter of significance that has come down to us was a native uprising which resulted in the destruction of Thebes.

When Soter II died in 80 B. C. he was succeeded by Ptolemy XII

(Alexander II), the son of Alexander I, who had spent much of his time in Rome during the stormy days of the preceding reigns and was given the position of king through Roman aid. But after a brief rule of twenty days, during which he first married, and then murdered Berenice, his cousin and step-mother, he was put to death by the enraged soldiers.

16. *The Flute-Player Becomes a King.*

The pictures which we have been compelled to portray of the rules of the later Ptolemies are in somber contrast to those of the brilliant courts of the founders of the dynasty. The golden city no longer presents the same resplendent picture; the Museum is filled no more with its intellectual heroes, — the poets, the scientists, the scholars who made it the most remarkable monument of antiquity. Quite fitting, therefore, is it that the last real king of Alexandria should prove to be the most worthless of all the rulers and should sink to levels of degradation that strain one's credulity to believe them.

This wretched monarch was Ptolemy XIII, known under the sonorous title of Philopator Philadelphus Neos Dionysus, but more properly called by his nickname, *Auletes*, the flute-player. Since the direct succession became extinct with the sudden death of his predecessor, Ptolemy XIII, the natural son of Ptolemy X, presented himself as the claimant to the vacant throne. This assumption was ratified by the people of Alexandria, but it was not acknowledged at Rome, for the claim was soon made that either Alexander I or Alexander II had left a will in which Egypt had been bequeathed to the Roman people.

The new Ptolemy seems to have been in character the weakest of the dynasty. Let those who doubt the power of the law of genetics to wreak vengeance upon those who violate its precepts ponder for a moment the nature of this worthless king. "He was not a man," says Athenaeus, "but a flute-player and a juggler." Auletes seems to have been in an almost continuous state of inebriation, and he passed his days in time-frittering amusements. He appears to have inherited the vicious temperament of his predecessors, but the trail of blood across his path is not so deep as those of others merely for the reason that Auletes did not possess the energies for a career of crime.

Since the alleged will of his predecessor had made his tenure quite precarious, Auletes sought in every way to propitiate the Roman senate.

Although the Romans did not confirm his succession, they did not molest him for some twenty-one years since, politically speaking, he was a harmless and innocuous individual who gave them no trouble. There is also no doubt that he was very liberal in the giving of gifts, which is a very simple and effective way of removing opposition if one can afford the luxury. For a long time the citizens of Alexandria suffered in patience the ever-mounting taxes, but in 58 B. C. they finally decided that matters had gone too far and Auletes was driven from his throne.

In the meantime the brother of Auletes, Ptolemy, the ruler of Cyprus, had been despoiled of his island by the Romans, who had taken it under the pretext that its ruler had been participating in piracy. Cato, who is traditional for his high standards of honor, had been sent to take charge of the island despite his protests at so ignominious a proceeding, and Auletes stopped there on his way to Rome. This interesting meeting between the high-minded Cato and the venal Ptolemy is graphically described by Plutarch as follows:

“In the meantime, Ptolemy, king of Egypt, who had left Alexandria, upon some quarrel between him and his subjects, and was sailing for Rome, in hopes that Pompey and Caesar would send troops to restore him, on his way thither desired to see Cato, for whom he sent, supposing he would come to him. Cato had taken purging medicine at the time when the messenger came, and made answer that Ptolemy had better come to him, if he thought fit. And when the king arrived, Cato neither went forward to meet him, nor so much as rose up to him, but, saluting him as an ordinary person, bade him sit down. This at once threw Ptolemy into some confusion, who was surprised to see such stern and haughty manners in one who made so plain and unpretending an appearance; but afterwards, when the king began to talk about his affairs, he was no less astonished at the wisdom and freedom of his discourse.

“For Cato blamed his conduct, and pointed out to him what honor and happiness he was abandoning, and what humiliations and troubles he would run himself into; what bribery he must resort to and what cupidity he would have to satisfy when he came to the leading men at Rome, whom all Egypt turned into silver would scarcely content. He therefore advised him to return home, and be reconciled to his subjects, offering to go along with him, and assist him in composing the

differences. And by this language Ptolemy being brought to himself as it might be out of a fit of madness or delirium, and discerning the truth and wisdom of what Cato said, resolved to follow his advice; but he was again over-persuaded by his friends to the contrary, and so, according to his first design, went to Rome. When he came there, and was forced to wait at the gate of one of the magistrates, he began to lament his folly, in having rejected, rather, as it seemed to him, the oracle of a god, than the advice merely of a good and wise man."

In the meantime the Alexandrians, believing that the king was dead, declared his daughter Berenice their queen. But when the news finally reached them that Auletes was in Rome, they immediately sent a delegation of a hundred citizens to present their own side of the story. As one may well believe, Auletes at once set up a counter-plot; by means of lavish bribes he contrived that many of the delegation should be slain on the road and the remainder so terrified that they feared to present their case.

Upon his arrival in Rome Auletes had been kindly received by Pompey and had also gained the invaluable support of Cicero. The latter so ably presented the case of the king before the senate that a decree of restoration was ordered by that body. But when the scandalous treatment of the envoys was finally noised abroad, a reaction set in and even the lavish purse of Auletes was not sufficient to stop the murmurs. The Sibylline books were consulted and an oracle was produced to the effect that "if a king of Egypt comes asking for aid, deny him not friendship, but do not assist him with numbers; if you do, you will have trouble and danger."

After a year or two spent in futile waiting while the Romans were trying to decide what to do in the matter, Auletes finally, through the help of Pompey, persuaded Gabinius, the Governor of Syria, to undertake the task of restoring him to his throne. The inducement required appears to have been a sum of money somewhere between six and ten thousand talents. Goaded by this magnificent spur, Gabinius first took Pelusium without opposition, and then defeated the Egyptians in a series of battles, both on land and on the river. Having finally made himself master of Alexandria, he put to death Archelaus, the consort of Queen Berenice, and handed over the throne to the mercies of Auletes. Thereupon, as Dio says, the king "put to death his daughter [Berenice] and many rich and prominent men, being in sore want of money."

The unauthorized campaign of Gabinius aroused great resentment in Rome, and considerable scandal developed with regard to the origin of the huge bribe itself. It appears that the money paid to Gabinius for his services was borrowed from a Roman by the name of Rabirius Postumus, although the actual funds came from no less a person than Julius Caesar. This we can infer from the fact that the Roman general later demanded payment in person for the debt. Poor Rabirius was at his wits' end to recover the great loan from the faithless king and finally he was sent to Alexandria to become the dioketes, thus having charge of the financial resources of the country. In his frantic desire to recover the money, Rabirius imposed burdensome taxes upon the people; and Auletes, now that he was finally upon his throne again, was far from helpful in smoothing out the troubles that beset this unfortunate creditor. At last Rabirius was forced to flee for his life; and he not only lost the sum of his loan, but his shirt as well, since the historians report that he was forced to escape from Alexandria without his clothes.

Although frequent riots occurred in Alexandria as a result of these high-handed methods of Auletes, the Roman soldiers under Gabinius kept the tumults well in hand and the worthless king was able to play his flute in comparative peace to the end of his days. He died finally in 51 B. C. leaving behind him a kingdom overwhelmed with debt, partially under the domination of Rome, and thoroughly dissatisfied with the trend of events.

But there was also one other possession that Auletes left, which was soon to sweep across the political sky like a bright comet. That was his daughter, the celebrated Cleopatra, who was then a young lady about seventeen years of age. Her remarkable story we shall tell in another part of our chronicle.

CHAPTER 6

MEDICINE AND MAGIC

1. *The Story of Aesculapius*

THE HISTORY OF MEDICINE might very properly begin with the story of the god Aesculapius, for, indeed, does not the famous oath of Hippocrates open with the words: "I swear by Apollo the physician, and Aesculapius, Hygieia, and Panacea, and all the gods and goddesses, that, according to my ability and judgment, I will keep this Oath and this stipulation." The history of medicine and the history of magic are inseparably entwined in the beginning, nor have the bonds between them been entirely severed in the present day. The god Aesculapius is a symbol of the mystery which belongs to the human body, of the delicate balances between sickness and health, and of the mysteries of the process of life itself.

Aesculapius was a favorite theme of artists and poets. His statues were exhibited in many places throughout the Hellenistic world. He stood beside healing springs and upon the tops of high mountains; he was found in temples in the vicinity of sanatoria and in schools of medicine; even in the Great Serapium at distant Memphis his shrine and that of the Semitic goddess Astarte were established in the same enclosure with the Egyptian deities Ptah and Serapis.

Aesculapius in his statues is commonly shown standing, enveloped in a long cloak, but with bare breast. His symbol is a heavy staff entwined with a serpent representing the principle of renovation. Telephorus, the boy genius of healing, and his daughter Hygieia, goddess of health, frequently accompany him.

The story of his life is filled with symbolism. His father, so says the legend, was the god Apollo, and his mother was Coronis, a maiden from Thessaly. Since Apollo was a god and Coronis a mortal, she could not reveal her secret and was forced by her father into marriage with her cousin Ischus. But when Apollo heard of this he was filled

with anger, and after the fashion of the gods, destroyed the unfortunate Ischus with an arrow. Then Coronis in her turn aroused the wrath of Artemis, the twin sister of Apollo, who slew her also.

But Apollo snatched the infant son from the funeral pyre of his mother and took him to Mount Pelion where he was placed in the care of Chiron, the Centaur. Here Aesculapius grew and learned from the wise Chiron the art of healing. So apt a pupil did he become that his powers far exceeded those of his master and he was able not only to cure the sick but also to bring the dead back to life again. This he did by means of the blood of the fabled Gorgon which he had obtained from the wise Athena. But Pluto, god of the underworld, complained to Zeus that the number of shades were being reduced by this magic art, — or so says Pindar in his third Pythian ode. And Zeus, lest the prerogatives of the gods be thus assumed by the healer,

“Was filled with wrath, and from Olympus top
With flaming thunderbolt cast down and slew
Laton’s well-loved son — such was his ire.”

By the machinations of Apollo Aesculapius was transported to the heavens and made a god after his death. According to the legend, the healer had married Epione, daughter of Merops, King of Cos. The best known of their children were two daughters, Hygieia and Panacea, and two sons, Machon and Podalirius. The two sons are among the leaders mentioned in Homer’s *Catalogue of the Ships*, and they are referred to as “good physicians both.” The names of the daughters are recognized, of course, as furnishing us with terms familiar in the everyday language of medicine.

That the wife of Aesculapius should have been the daughter of the king of Cos is very appropriate because this small island, not far from the southwestern corner of Asia Minor at the mouth of the Gulf of Helicarnassus, became a center of medical knowledge and developed a number of sanatoria famous throughout the Hellenistic world. But more remarkable than that was the fact, also, that Cos was the birth-place of Hippocrates, the Father of Medicine.

Cos, as we have had occasion to remark earlier in our chronicle, was closely associated with Alexandria, at least during the early years of the golden city. The fact that it was a center of medicine

long before the time of the first Ptolemies, undoubtedly exerted an influence upon the selection of medicine as one of the studies to be included in the curriculum of the Museum. The precinct of Aesculapius was located upon the slopes of Mount Prion about two miles from the town of Cos. This consisted of three terraces. On the upper one of these there was a temple approached by an imposing flight of steps, which was apparently built during the second century B. C. This area itself was doubtless of a much earlier date. This terrace also contained a cypress grove and porticoes. The second level was adorned with several temples, an altar, and other buildings, while the lower terrace formed a kind of sacred area enclosed with porticoes. A destructive earthquake appears to have reduced the medical sanctuary to ruins, but it was restored by Xenophon, the physician of the Emperor Claudius.

2. *Magic and the Art of Healing.*

If one is to realize the truly great stature of Hippocrates, and of those who followed him two centuries later in the Alexandrian Museum, one should picture, if he can, the state of medicine in that early period of history. For the human body, and the functions of the life which animates it, were then a profound mystery. Its relationship to the external world was almost completely misunderstood. The causes of disease were unknown; their relationship to sanitation was not even dimly suspected; such cures as were proposed were devised for the most part from current folk lore.

In an endeavor to penetrate the mystery of human illness a metaphysical origin was first and most logically sought for. What more natural to believe than that a person overtaken by one of the countless ills to which the flesh is heir should be dominated by an evil demon, or seized by a wilful god? Is it any wonder, then, that sacrifices to these baneful spirits should be the first purgative and the magician with his incantations the first physician?

About this origin of magic in the art of human healing Pliny gives us a vivid picture in his *Natural History*, which, let it be remembered, was written some time during the later years of the first century of our era:¹

¹ xxx, 1.

“That [magic] first originated in medicine, no one entertains a doubt; or that, under the plausible guise of promoting health, it insinuated itself among mankind as a higher and more holy branch of the medical art. Then, in the next place, to promise the most seductive and the most flattering, it has added all the resources of religion, a subject upon which, at the present day, man is still entirely in the dark. Last of all, to complete its universal sway, it has incorporated with itself the astrological art; there being no man who is not desirous to know his future destiny, or who is not ready to believe that this knowledge may with the greatest certainty be obtained, by observing the face of the heavens. The senses of men thus being enthralled by a three-fold bond, the art of magic has attained an influence so mighty that at the present day even, it holds sway throughout a great part of the world, and rules the kings of kings in the East.”

Those more enlightened began to explore the curative possibilities inherent in herbs and other substances; but this exploration, unguided by any scientific principles, was random and unsatisfactory. The chance for chicanery and all forms of charlatanism was very great. An interesting example of this is found in the legend of the mandrake, a plant of the potato family, which was much sought after for its medicinal properties. It was used in various ways, — for an emetic, a purgative, and a narcotic, although it has fallen into well-deserved disrepute in the modern pharmacopaea. But a halo of superstition surrounded the mandrake in early days, and one may well imagine the fancy fees that were charged for a drug so difficult to obtain. For, according to the story of those who gathered it, the mandrake, since its two-pronged root resembled in appearance a human being, gave a terrible shriek when it was pulled from the earth. And so direful was this sound that those who heard it were instantly struck dead. Hence, to gather the mandrake, dogs were employed and while the harvester remained at a safe distance, his ears stopped up with wax, the poor animals were fastened to the root and pulled it from the ground. Since every root required the life of a dog, one can easily imagine the cost of the drug to the ultimate consumer. Even in Pliny's time a vestige of the legend remained for he makes the following curious statement concerning it: “Persons, when about to gather the plant, take every precaution not to have the wind blowing in their face; and, after tracing three circles around it with a sword, turn toward the west and dig it up.”

We shall not dwell too long upon these phases of the ignorance and superstition of those early years of mankind. Do we not find in our own enlightened age far too much of the mystery and magic that has beset the thorny pathway of science? But if one is to comprehend the real magnitude of those scholars who saw more clearly than their fellows the implications of the scientific method, it is necessary to understand their difficulties. In his indictment of the magicians Pliny gives many examples of their prescriptions. A few of these may be illuminating. Thus we find in the *Natural History* this characteristic passage:

“But to proceed with the remedies for tooth-ache — the magicians tell us that it may be cured by using the ashes of the head of a dog that has died in a state of madness. The head, however, must be burnt without the flesh, and the ashes injected with oil of cyprus into the ear on the side affected. For the same purpose, also, the left eye-tooth of a dog is used, the gum of the affected tooth being lanced with it; one of the vertebrae also of a dragon or of an enhydris, which is a male white serpent. The eye-tooth, too, of this last, is used for scarifying the gums; and when the pain affects the teeth of the upper jaw, they attach to the patient two of the upper teeth of the serpent, and, similarly, two of the lower ones for tooth-ache in the lower jaw. Persons who go in pursuit of the crocodile anoint themselves with the fat of this animal. The gums are also scarified with the frontal bones of a lizard, taken from it at full moon, and not allowed to touch the ground; or else the mouth is rinsed with a decoction of dogs’ teeth in wine, boiled down to one half. Ashes of dogs’ teeth, mixed with honey, are useful for difficult dentition in children, and a dentifrice is similarly prepared from them.”

But even if we leave the magicians and enter the offices of the more reputable members of the healing profession, our prescription might come nearer to killing than to curing us. Although the reader must be warned that Pliny was hostile to the physicians of his day, and made little effort to set them in their best light, it is nevertheless quite probable that most of his alleged remedies were in the *Materia Medica* of the more enlightened members of the medical profession. But it is rather difficult to believe that if we had consulted a physician on the cure of snake-bite he would seriously have given us his prescription on the basis of the following passage in his authority:

"The flesh of cocks and capons, applied warm the moment it has been plucked from the bones, neutralizes the venom of serpents; and the brains, taken in wine, are productive of a similar effect. The people of Parthia, however, prefer applying a hen's brains to the wound."

In another part of the *Natural History* we find many passages on the virtues of certain herbs, a characteristic statement being the following:

"The asphodel is one of the most celebrated of all plants... It has been observed that the bulbs of asphodel, boiled with pisan, are remarkably good for consumption and phthisis, and that bread in which they have been kneaded up with the meal, is extremely wholesome. Nicander recommends also, for the stings of serpents and scorpions, either the stalk, ... or else the seed or bulbs to be taken in wine, in doses of three drachmas... The asphodel is prescribed also for wounds inflicted by marine animals of a venomous nature, and the bite of the land scolopendra... The leaves, too, are applied with wine to wounds made by venomous animals, and the bulbs are beaten up with polenta and similarly used for affections of the sinews and joints... Boiled in lees of wine, and applied in a linen pledget, they are used for the cure of defluxions of the eyes... The juice extracted by pounding them, or else a decoction of them, is good, mixed with honey, for pains in the body; it is applied also with dried iris and a little salt by those who wish to impart an agreeable odor to the person... The ashes of the root are a remedy for baldness and chaps on the feet; and an extract of the root, boiled in oil, is good for burns and chilblains. It is injected also into the ears for deafness, and, for tooth-ache, it is poured into the ear opposite to the part affected."

We could expatiate much further upon the virtues of the asphodel as recorded by Pliny. In fact, it possessed so many curative properties, that we wonder why our authority did not shorten his account by enumerating the few things for which the herb was not effective, rather than by telling us of the remedies that could be made from it.

Although these quotations from the *Natural History* are cited to show the state of medical information which prevailed in the early centuries, one must not get the impression that all the information imparted was incorrect. Some truth was mixed with quantities of error. Nor must one believe that the work of Pliny was held in disrepute, since its influence comes down almost to our own day. Belief in cura-

tive properties of asphodel, if this plant can be identified with the modern daffodil, when used as a balm in the alleviation of the pain of wounds, is still current in some places. Even a *Materia Medica Americana*, published in America in 1780, contained statements undoubtedly derived from the *Natural History* of Pliny.

3. *Hippocrates, Father of Medicine.*

The need of medicine, in its endeavor to sift the true from the false, and to eliminate the magic of the charlatan from its practices, was the scientific method. Observation of phenomena, a direct study of the functions of the human body, an insight into methods for discovering efficacious results in the use of medicines, a logical process for detecting when the cure was an accidental concomitant of the remedy, — all of these were greatly needed. Only genius of the highest kind could hope to make any progress in the midst of such wide-spread superstition and error. Such genius was found in the person of Hippocrates, the first great physician, who before all others substituted scientific method for the method of superstition and magic.

Hippocrates was born on the island of Cos about the year 460 B. C. and died at Larissa in Thessaly at an advanced age, which has been variously estimated from 85 to 109 years. Information about his life is scanty enough and subject to both error and exaggeration since his earliest biographer lived in the second century of our era. His father, Heraclides, belonged to the family of the Aesculepiadae, which claimed direct descentance from Aesculapius; and his mother's family asserted that Hercules was among their ancestry. Hippocrates studied medicine under his father and also under Herodicus of Symbria; his training in philosophy was derived from Gorgias of Leontini and Democritus of Abdera. He also received training in the famous medical center of Cos, and probably also at Cnidos. Later he traveled extensively in Greece, and probably practiced his profession in Athens, as well as in Thrace, Thessaly, Delos, and his native island.

Many legends have grown up around the figure of Hippocrates. One story, for example, asserts that Perdiccas, the king of Macedonia, once summoned the famous physician to his court to cure him of consumption from which he was wasting away. But Hippocrates dis-

covered that the cause of the king's trouble was love-sickness and he thus speedily achieved a cure. Another tale says that the great physician was called to Athens to stay a plague that had enveloped the city and that the pestilence abated as soon as Hippocrates ordered great fires of wood of some aromatic kind to be lighted around the city.

An extensive library of Hippocratic writings has been accumulated during the centuries, but many of these are doubtless spurious additions made by his followers. However this may be, these writings all reflect the one cardinal principle of Hippocrates, the necessity of painstaking observation, and the complete rejection of a metabasis for disease.

We possess a number of clinical case histories given by Hippocrates and these have a very modern tone to them. Thus, consider the following, which has been considerably abbreviated:

Case X.

"The man of Clazomenae, who lay sick by the well of Phrynichides, was seized with a fever. Pain at the beginning in head, neck, and loins, followed immediately by deafness. No sleep; seized with acute fever; Hypochondrium swollen, but not very much; distension; tongue dry.

"*Fourth day.* Delirium at night.

"*Fifth day.* Painful.

"*Sixth day.* All symptoms exacerbated.

"About the eleventh day slight improvement. . .

"*Twentieth day.* A crisis left the patient free from fever; no sweating; quite rational. About the twenty-seventh day violent pain in the right hip, which quickly ceased. The swellings by the ear neither subsided nor suppurated, but continued painful. . .

"*Fourtieth day.* Pain in the right eye; sight rather impaired; recovery."

Although many of the details given by Hippocrates in his record of the case have been deleted, they are sufficiently explicit so that a modern diagnosis can actually be given. The full record was submitted individually to a number of physicians in order to test the

THE OATH OF HIPPOCRATES

I swear by Apollo the physician, and Aesculapius, Hygieia, and Panacea, and all the gods and goddesses, that, according to my ability and judgment, I will keep this Oath and this stipulation — to reckon him who taught me this Art equally dear to me as my parents, to share my substance with him, and relieve his necessities if required; to look upon his offspring in the same footing as my own brothers, and to teach them this art, if they shall wish to learn it, without fee or stipulation; and that by precept, lecture, and every other mode of instruction, I will impart a knowledge of the Art to my own sons, and those of my teachers, and to disciples bound by a stipulation and oath according to the law of medicine, but to none others.

I will follow that system of regimen which, according to my ability and judgment, I consider for the benefit of my patients, and abstain from whatever is deleterious and mischievous. I will give no deadly medicine to any one if asked, nor suggest any such counsel; and in like manner I will not give to a woman a pessary to produce abortion. With purity and with holiness I will pass my life and practice my Art. I will not cut persons laboring under the stone, but will leave this to be done by men who are practitioners of this work.

Into whatever houses I enter, I will go into them for the benefit of the sick, and will abstain from every voluntary act of mischief and corruption; and, further, from the seduction of females or males, of freemen and slaves. Whatever, in connection with my professional practice, or not in connection with it, I see or hear, in the life of men, which ought not to be spoken of abroad, I will not divulge, as reckoning that all such should be kept secret. While I continue to keep this Oath unviolated, may it be granted to me to enjoy life and the practice of the art, respected by all men, in all times! But should I trespass and violate this Oath, may the reverse be my lot.

matter, and the group was overwhelmingly of the opinion that the patient of Hippocrates had been afflicted with typhoid fever. Some even thought that they could identify the type.

The astonishing nature of this document cannot be over-stated; for here, in the midst of mystery and magic, surrounded by every kind of quackery that human ingenuity could devise, Hippocrates records a simple, scientific, clinical history. Nothing irrelevant is mentioned; everything that could be observed as pertinent to the patient's condition is given. Nothing is stated as to the methods of cure which were employed, but the document gives a careful, scientific record of the march of the disease until Nature finally effected the recovery of the patient. There are few examples in the entire literature of the ancients which are so understandable to the scientists of the modern world.

The four tenets of the Hippocratic method appear to be: first, the complete adherence to the principle that medical science is founded upon observation and deduction from such observation, not upon philosophical speculations; second, that an illness is attended by a critical period, the outcome of which determines whether the patient is to recover or not; third, the importance of diet in the treatment of disease, the avoidance, for example, of heavy food; fourth, the assumption that health is caused by a "coction" of the "humors." By a coction is meant the process whereby the fluids of the body are able to readjust themselves under the attack of the disease, and through the medium of the crisis finally to restore the patient to health. It is obvious that this theory was only a manner of speaking of the natural processes of the body and had no real scientific status. This theory, however, as one might easily believe, was one of the parts of the Hippocratic doctrine which was most eagerly seized upon by his successors, since the mysterious words could be used when stubborn facts were difficult to obtain.. The genuine scientific part of the Hippocratic teaching, that of observation and interpretation, was allowed to languish during the succeeding centuries.

Many aphorisms have been derived from the writings of Hippocrates and his school, as, for example, the following: "Life is short and art is long; opportunity is fleeting, experience fallacious, and judgment difficult. The physician must not only do his duty himself,

but must also make the patient, the attendants, and the externals cooperate." We have already mentioned the famous *Oath of Hippocrates*, which is still cherished by the medical profession as one of the most eloquent expressions of the obligation of the physician to his art. A translation of the Oath is reproduced on Page 169.

4. *Medical Science in the Museum.*

The next advance in medicine began in Alexandria shortly after the establishment of the Museum, for this science was included in the program of that famous center of learning. Unfortunately we have little information about these important activities, but enough has come down to us so that we can recognize in the person of Herophilus one of the greatest physicians of antiquity.

Born in Chalcedon in the latter part of the fourth century B. C., Herophilus was brought to Alexandria by Ptolemy Soter, where he was a contemporary of Euclid, the geometer. He became the founder of anatomy, and after Hippocrates and Galen (whom we shall discuss later), was regarded as the greatest physician of antiquity.

It appears that Herophilus believed in the empirical method and his study of anatomy was made by direct observations, and not by conjecture. His work was detailed and masterful and his descriptions, according to the comments of such authorities as Galen and Celsus, were of a high order. Among other things he gave a detailed description of the brain; he discussed the difference between tendons and nerves, and recognized the functions of the latter. He made a study of the eye and described the optic nerve and the retina. The vascular system was examined and a careful description given of the chyli-ferous vessels. He distinguished between arteries and veins, and introduced the water-clock in measuring the pulse, data which he described and analyzed carefully.

This remarkable Alexandrian reached the conclusion that the body is governed by four forces, that of heating in the heart, that of perceiving in the nerves, that of nourishing in the liver, and that of thinking in the brain. He described such organs as the liver and the pancreas in detail and studied the functions of the salivary glands.

Herophilus introduced the use of many new drugs, and was a proponent of the efficacy of blood-letting in the treatment of disease.

His work in obstetrics set a model for future generations and his text-book on the subject was in wide use for centuries. His anatomical writings were produced in three volumes which, most unfortunately, have disappeared.

The successor of Herophilus in the Alexandrian school was Erasistratus, who, born about 304 B. C. in Ceos, one of the Cyclades, flourished in the Museum around the middle of the third century. He is known as the Father of Physiology, although his achievements in anatomy were second only to those of Herophilus. He is also called the founder of comparative and pathological anatomy.

But for his belief that the arteries were filled with air he might very easily have anticipated William Harvey's discovery of the circulation of the blood which was not published for twenty centuries thereafter. For he suspected that the final ramifications of the arteries and the veins were connected; and he had reached the conclusion that every organ was connected by the three-fold system comprised of arteries, veins, and nerves.

Like Herophilus before him, Erasistratus strongly rejected the theory that occult causes were found in the behavior of the functions of the body. He also was the first physician to reject the old humoral theory of Hippocrates; and he distinguished between therapeutics and hygiene, laying particular stress upon the latter and its relationship to health. He opposed the use of too many drugs and too much blood-letting in the treatment of disease. In a word, Erasistratus had a point of view in medicine that was astonishingly modern.

Both Herophilus and Erasistratus have been accused of the vivisection of human beings, the authority for which is Aurelius Cornelius Celsus, who flourished under the Emperor Tiberius from 14 to 37 A. D. Since this is a curious matter, though not one entirely unknown in the annals of medical science, it is perhaps instructive to read the entire passage from Celsus:¹

“Besides, as pains and various other disorders, attack the internal parts, they [who declare for a theory of medicine] believe no person can apply proper remedies to those parts of which he is ignorant; and, therefore, that it is necessary to dissect dead bodies, and

¹ *Of Medicine*, i, preface.

examine their viscera and intestines; and that Herophilus and Erasistratus had taken for the best method for attaining that knowledge, who procured criminals out of prison, by royal permission, and dissecting them alive, contemplated, while they were even breathing, the parts which nature had before concealed; considering their position, color, figure, size, order, hardness, softness, smoothness, and roughness; ... for say they, when there happens any inward pain, a person cannot discover the seat of that pain, if he has not learned where every viscus or intestine is situated; nor can the part, which suffers, be cured by one who does not know what part it is; and that when the viscera happen to be exposed by a wound, if one is ignorant of the natural color of each part, he cannot know what is sound and what is corrupted... And that it is by no means cruel, as most people represent it, by the tortures of a few guilty, to search after remedies for the whole innocent race of mankind in all ages."

As one may well imagine there was a violent reaction to this practice of the experimenters, and the thunders reverberated even down to the time of St. Augustine (354-430). Especially strong in his denunciations was Tertullian (c. 155-222), one of the greatest writers of the Roman church.

The only other name that has come down to us from the Alexandrian school of this early period is that of Eudemus, who was a younger contemporary of Herophilus and Erasistratus. His field of investigation was anatomy, and he deepened the knowledge of the nervous system, of the bones, and other parts of the body.

5. Galen and his Influence.

Although Alexandria remained a center of medical instruction throughout most of its history, scientific progress in the art of healing declined along with other branches of learning after the beneficent Ptolemies had been succeeded by the less enlightened members of their dynasty. But we hear very little about this medical training until the time of Claudius Galen, who seems to have completed his studies in the golden city.

Since Galen, next to Hippocrates, was the most famous physician of the ancient world, and since he followed the Father of Medicine by some six centuries, it will be instructive to estimate the progress that had been made during that long stretch of time.

Galen was born in Pergamum in the year 130 A. D. Nicon, his father, from whom he received his early education, appears to have been a man of high culture and ability, a wealthy architect of the city, who saw that his son was well trained in the fundamental studies. About his parents Galen makes the following statement: "I had the great good fortune to have as a father a highly amiable, just, good, and benevolent man. My mother, on the other hand, possessed a very bad temper; she used sometimes to bite her serving-maids, and she was perpetually shouting at my father and quarreling with him — worse than Xanthippe with Socrates." Although Galen resolved to be more like his father than his mother, his writings lean toward the polemical and he was not a man who would go out of his way to avoid a controversy.

At the age of sixteen Galen resolved to study medicine and five years later, on the death of his father, he left his native city and went to Smyra. From there, after some extensive travel, he finally arrived in the golden city where he remained until the age of twenty-eight. It is unfortunate for our chronicle that Galen has left us no detailed account of the facilities of the medical center in Alexandria. He seems to have had few if any opportunities for human dissection, since he expressed his happiness in being able to examine two human skeletons. Most of his work was done with apes, dogs, and swine, as a result of which his anatomical descriptions sometimes exhibit gross errors.

Since Galen resided in Alexandria during a period when great internal disturbances plagued the golden city, as we shall later describe in our chronicle, one cannot believe that science was maintained at a high level during the years of his residence there. Although Emperor Hadrian had visited Alexandria in the year 130 and had established some new professorships in the Museum, the tide of scholarship was running strongly in the direction of metaphysics and ebbing on the side of science. The political situation in the city was full of turmoil and the thoughts of the people were directed toward the troubles of a precarious life rather than toward the speculations of science.

When Galen had completed his studies in Alexandria he returned in the year 158 to his native city of Pergamum to assume the office

of medical adviser to the athletes of the gymnasium. This institution was located within the precincts of the temple of Aesculapius. After about five years, however, a revolt compelled him to leave this position and he decided to try his adventures in Rome.

In the capital of the Roman world Galen achieved a rapid and remarkable success. He succeeded in curing Eudemus, a celebrated peripatetic philosopher, and several other prominent people, whose praises soon brought him a large and lucrative practice among the best families. So greatly was his skill admired that he received the titles of *Paradoxologus*, the wonder-speaker, and *Paradoxopoeus*, the wonder-worker. His spectacular success naturally brought down upon his head all the hatred that jealousy could inspire among the other physicians of Rome. Moreover, Galen was not even a native citizen, but an alien Greek. For then, as now, and probably to the end of time, the appearance of novel theories, especially if they are attended by success, constitutes an intolerable crime in the eyes of competing scientists. Witness, for example, the bitter complaint of Sir Isaac Newton, centuries later, when his theory of optics evoked such a storm of controversy. "For I see " he wrote, "a man must either resolve to put out nothing new, or to become a slave to defend it."

As a result of this hostility from the physicians in Rome, Galen in 168 left for his home in Pergamum, where he settled down to enjoy a life of scholarship. But he was not left long in peace for Emperor Marcus Aurelius, who had a deep and genuine appreciation of true learning, summoned him back to Italy. The emperor was about to undertake an expedition against the Germans and he desired to have in his entourage the most famous physician in the empire.

Galen vigorously protested this appointment, but, if we can believe the story, he prepared for the emperor one of his famous *theriacs*. This curious medicine was supposed to be an antidote for poison and the bites of venomous animals, a very useful constituent in the pharmaceutical chest of an emperor in those dangerous centuries, as one may well imagine.

The story of poisons is, itself, rather interesting and considerable attention was devoted both to their preparation and to the discovery of antidotes. Among the investigators of the properties of theriacs was King Mithridates VI of Pontus, called Mithridates the Great,

who lived from about 132 B. C. to 63 B. C. and was finally conquered by Pompey. The following account of his experiments is given by Pliny in his *Natural History*:¹

“Mithridates, the most powerful monarch of [his] period, . . . is generally thought to have been a more zealous promoter of discoveries for the benefit of mankind than any of his predecessors — a fact evinced not only by many positive proofs, but by universal report as well. It was he who first thought, the proper precautions being duly taken, of drinking poison every day; it being his object, by becoming habituated to it, to neutralize its dangerous effects. This prince was the first discoverer too of the various kinds of antidotes, one of which, indeed, still retains his name (the mithridates); and it is generally supposed that he was the first to employ the blood of the ducks of Pontus as an ingredient in antidotes, from the circumstance that they derive their nutriment from poisons.”

When Galen refused to accompany Emperor Marcus Aurelius on his expedition, the emperor persuaded him to remain in Rome as the personal physician of the young prince Commodus. What happened next we do not know, but it is probable that Galen finally retired to Pergamum and devoted the rest of his life to writing. He died at a ripe old age near the end of the century.

The influence of Galen upon future generations was enormous. He was the most prolific medical writer of antiquity and his vivid style made an appeal to those who followed him. It is said that he wrote five hundred treatises on subjects as varied as medicine, logic, ethics, and grammar.

But it is difficult to appraise the true stature of Galen as a man of science. For, while his reputation and influence were very great, if his actual words are compared with those of Hippocrates, the impression is distinctly gained that the Father of Medicine had far more of the modern spirit of critical research than Galen, despite the centuries between them. The following appraisal given by F. H. Garrison in his scholarly *History of Medicine* is unquestionably the modern verdict:²

“Compared with Hippocrates, Galen seems like the versatile, many-sided man of talent as contrasted with the man of true genius.

¹ xxv, 3. ² Philadelphia, first ed., 1913, fourth ed., 1929, pp. 112-113.

He was the most skillful practitioner of his time, but left no good accounts of clinical cases, only miraculous cures. He got his patients well, but to this end instituted an elaborate system of polypharmacy, the memory of which survives in our language in the terms 'galenicals', as applied to vegetable simples. Galen's place in science is very high, but his roving disposition undoubtedly did much to develop that cocksure attitude of mind, which made his writings the fountain-head of ready-made theory and 'polypragmatism'. He had a ready answer for every problem, a reason to assign for every phenomenon. He elaborated a system of pathology, which combined the humoral ideas of Hippocrates with the Pythagorean theory of the four elements and his own conception of a spirit or 'pneuma' penetrating all the parts. Referring all pathological phenomena back to these postulates, Galen with fatal facility and ingenuity, proceeded to explain everything in the light of pure theory, thus substituting a pragmatismal system of medical philosophy for the plain notation and interpretation of facts as taught by Hippocrates. The effect of this dogmatism and infallibility upon after-time was appalling; for while Galen's monotheism and piety appealed to the Moslems, his assumption of omniscience was especially adapted to appease the mental indolence and flatter the complacency of those who were swayed entirely by reverence for authority. Up to the time of Vesalius, European medicine was one vast *argumentum ad hominem* in which everything relating to anatomy and physiology, as well as disease, was referred back to Galen as a final authority, from whom there could be no appeal. After his death, European medicine remained at a dead level for nearly fourteen centuries."

CHAPTER 7

THE EARTH IS A SPHERE

1. *Measuring the Earth*

IF THE READER WILL TURN to a map of Egypt he will find upon the Nile some 520 miles south of Alexandria as the crow flies, but considerably longer by road or river, the town of Assuan, known in the time of the Ptolemies as Syene. This town stands on the east bank of the Nile, facing Elephantine Island, just below the First Cataract. That it was an important place in the Macedonian rule of Egypt is attested by the fact that a temple to Isis was built there by Euergetes I and Philopater. Carvings of the former, sacrificing to the gods, are still visible in the ruins.

But to us and the story of Alexandria this ancient town has a different significance; for from this place came the first suggestion of a method for computing the size of the earth. Today the most ignorant among us knows that the earth is spherical in shape and that we cling to its surface by the mysterious force of gravitation. But in that ancient time, when science was just beginning its flight, the boldest imagination was required to picture the earth as it really is and to estimate its size.

Although there are references in some of the early writers as to the form and the size of the globe on which we dwell, it was left to Eratosthenes, the wise man of Alexandria, to devise a practical method for measuring its circumference. This great achievement, together with other matters relating to the foundations of scientific geography, give imperishable glory to the name of this ancient scholar.

2. *Eratosthenes, the Wise Man of Alexandria.*

Eratosthenes, if we may believe the record, was born about 276 B. C. in Cyrene, the original capital of ancient Cyrenaica and one of the greatest of the Greek colonies. Here as a youth Eratosthenes must

have been surrounded by the highest culture, since Cyrene was noted among the ancients for its intellectual life. It had a famous medical school and had produced both Callimachus, the Alexandrian poet, and Aristippus (c. 435-356 B. C.), a pupil of Socrates and the founder of the so-called *Cyrenaics*. This was a school of philosophy which held that pleasure was the highest form of existence. That Cyrene continued for many years to sustain an intellectual life is attested by the fact that it was the birthplace of Carneades (214-129 B. C.), founder of the New Academy at Athens and one of the first sceptics, and also of Synesius (c. 373- c. 414), a disciple of the Neoplatonist Hypatia.

Although Cyrene was some 500 miles west of Alexandria it had made submission by embassy to Alexander in 331 B. C. and ten years later passed under Ptolemaic domination. It was thus natural that the Cyrenians should turn their eyes toward the golden city and that the more adventurous among them should seek stimulus there. Hence it was that Eratosthenes, probably at a reasonably early age, followed his fellow citizen Callimachus to Alexandria and became one of his pupils.

We next hear of Eratosthenes at Athens where he studied philosophy under Ariston (c. 250 B. C.), the Stoic, and under Arcesilaus (316-241 B. C.), founder of the Middle Academy, who taught that probability is the best guide in practical affairs, since "we know nothing, not even our ignorance." Eratosthenes returned to Alexandria about the age of forty, summoned there by Ptolemy III, (Euergetes), first to be a tutor for his son and later to assume the duties of chief librarian vacated by the death of Callimachus in 240 B. C.

By all reports Eratosthenes was a man of vast learning and the author of books on many subjects. Unfortunately only fragments of these have come down to us. But judging from the many references to his works by subsequent authors there is no doubt that he was one of those men rare in any age, — a versatile genius. He called himself *Philologos*, or one who loved learning. In honor of his varied accomplishments his friends called him *Pentathos*, a name applied to a champion and conqueror in the five Grecian games. His enemies named him *Beta*, thus thinking to imply that, while he was second in all fields of learning, he was first in none of them.

Since his writings are lost we cannot now appraise the true stature of Eratosthenes, but it is known that he devoted much attention to mathematics. He invented what is known today as the *sieve of Eratosthenes* for finding prime numbers, that is to say, numbers which are divisible only by themselves and unity. The device has been used in recent times in the construction of the great tables of prime numbers which we now possess.

The sieve may be described as follows: Let all the integral numbers, that is to say, 1, 2, 3, 4, 5, and so on, be written in sequence. Then, beginning with 2, cross out every second one in the series. Since 3 is now the first uncrossed number we begin anew with it and cross out every number three units apart. The sequence of undeleted numbers, that is to say, 2, 3, 5, 7, 11, 13, and so on, contains the primes, whose curious and striking properties have been the subject of much modern investigation.

Eratosthenes also gave a solution of one of the famous problems of ancient Greek geometry, namely, that of *the duplication of the cube*. This problem originated in rather a curious manner. According to one legend the Delians were affected by a plague and were told by their oracle that they must build an altar double the size of the existing one. When they consulted Plato he told them that the god did not really wish a larger altar, but that he wanted to shame the Greeks for having neglected mathematics and geometry.

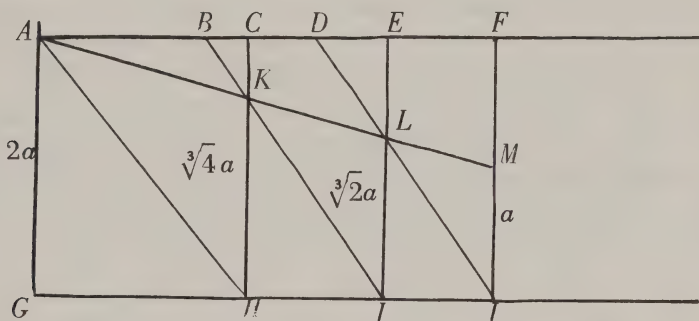
The problem, as one may readily see, is equivalent to finding the cube-root of 2, since, if a is the linear dimension of the original altar, then a value x is required such that $x^3 = 2a^3$. The problem may be shown to be equivalent to finding two mean proportionals between the lengths a and $2a$, that is to say, quantities x and y such that $a : x = x : y = y : 2a$. From these equations we have $x^2 = ay$ and $y^2 = 2ax$, and hence, upon the elimination of y , we obtain the required equation: $x^3 = 2a^3$.

The Greeks could find no way, nor, indeed, did one exist, for solving the problem by permitted geometrical constructions, that is to say, by the use of compasses and a straight edge alone. Hence new devices were sought to solve the problem.

Eratosthenes devised a series of sliding triangles, namely, the triangles BIE and DJF of the figure, such that when the points A , K ,

L , and M had been brought into line, the length IL was the desired side of the new altar. So pleased was Eratosthenes with this device that he erected to Ptolemy II a votive monument on which was fixed a bronze representation of his contrivance for solving the problem.

Eratosthenes was also an able student of the humanities in which, perhaps, his greatest work, unfortunately not extant, was an encyclopedia in twelve books on *The Old Attic Comedy*. This subject he treated, not in the chronological manner, but as a series of mono-



graphs about the authors, discussing points of textual criticism, language, and subject matter.

It is a pity that more of the work of Eratosthenes has not come down to us for the few fragments which we have show a pithy style. Thus, in speaking of the habits of Ariston of Chios, the Stoic philosopher whom we have mentioned above, he says: "Many a time before this have I caught him in the act of digging through the wall which divides pleasure from goodness, and popping up on the side of pleasure." And speaking of the powers of drink he says: "There is wine, which has the strength of fire when it enters into men; it swells them as the north and south wind swells the Libyan sea, and brings to light the hidden things in the deep; so wine drives the wits from men in complete upheaval." On the virtues of persistence he makes the aphorism: "To those who thrice wipe the mouth, the gods give a better portion."

Eratosthenes saw clearer than others of his day the real significance of the works of Homer. All wisdom was not to be found in

them, but they were to be esteemed for what they were, — beautiful poems, written to charm the imagination of men and not to instruct them. “The scenes of the wanderings of Odysseus,” he said, “will be found when you find the cobbler who sewed up the bag of the winds, and not before.” This point of view greatly aroused the ire of Strabo in later times who says in his *Geography*:

“And Eratosthenes gives himself quite unnecessary pains when he asks how it adds to the excellence of the poet for him to be an expert in geography, or in generalship, or in agriculture, or in rhetoric, or in any kind of special knowledge with which some people have wished to invest him. Now the desire to endow Homer with all knowledge might be regarded as characteristic of a man whose zeal exceeds the proper limit... You may be right, Eratosthenes, on that point, but you are wrong when you deny to Homer the possession of vast learning, and go on to declare that poetry is a fable-telling old woman, who has been permitted to ‘invent’ (as you call it) whatever she deems suitable for purposes of entertainment.”

Strabo’s criticism of Eratosthenes and his apparent disparagement of poetry seems a little curious in view of the fact that Eratosthenes wrote a considerable amount of respectable verse, minor epics and elegiacs, and one, or perhaps two, long poems. These latter were called the *Hermes* and the *Erigone*, although the second may be a part of the first, which is also sometimes referred to as *Catalogi*. The *Hermes* is an astronomical poem, probably much in the nature of the *Phaenomena* of Aratus, which begins with the birth of the god Hermes, recounts his adventures, and then passes to the legend that the god arranged the heavens, the zones, and the stars. The poem thus became a vehicle for describing the current knowledge about astronomy.

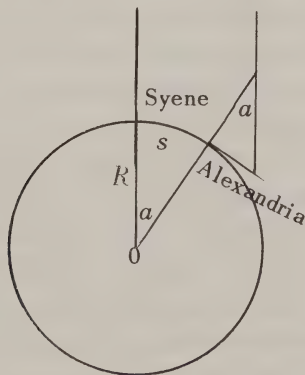
But of all the achievements of Eratosthenes by far the greatest was that of establishing the basis for scientific geography. In this he was certainly not *Beta*, if we have given a proper interpretation to this nickname, but *Alpha* with a star upon it. Eratosthenes appears to have given his findings in a treatise in three books called the *Geographica* and in a separate work *On the Measurement of the Earth*. In his geography Eratosthenes began with an historical account of the subject. He then discussed the spherical form of the earth, and described the position of the various land masses as he knew them.

He pointed out the insignificant character of mountains in comparison with the size of the earth and estimated that the highest ones did not exceed in elevation 100 stadia (about 12 miles).

Eratosthenes also, it would seem, made the first attempt to set up a scientific chronology which began with the siege of Troy. These results were given in his work entitled *Chronographiai*.

3. Estimating the Earth's Circumference.

The method used by Eratosthenes in measuring the size of the earth has remained essentially unchanged since his day and may be described as follows: He observed that at Syene at the time of the summer solstice no shadow fell into a well at noontime, a fact so curious that it must have been commented on by travelers. This meant, of course, that Syene was directly under the Tropic of Cancer, or at least, nearly so. At the same time Eratosthenes measured at Alexandria the shadow of the gnomon, — an astronomical instrument like the vertical triangular plate of a sun-dial, — in order to determine its latitude.



This he found to be one-fiftieth of a great circle, namely, the angle a in the accompanying figure. The distance between Syene and Alexandria he estimated to be 5,000 stadia, that is to say, the distance represented by s in the figure. Hence, since $s = aR$, where R is the radius of the earth, and since the circumference of the earth is equal to $2\pi R$, Eratosthenes immediately made the estimate that the desired circumference was equal to $50 \times 5,000 = 250,000$ stadia. For some reason not known to us now, but perhaps in order to make his circumference divisi-

ble by 360, Eratosthenes added 2,000 to this figure, an addition that could be justified on the basis of the error that necessarily existed in the measurement of the distance between Syene and Alexandria.

Hence Eratosthenes reached the conclusion that the circumference of the earth was 252,000 stadia. This fact, however, is far from telling us the accuracy of the estimate, since the value of the stadium is not clearly defined. If we assume that Eratosthenes was using the ordinary stadium equivalent to one-tenth of a geographical mile of 6,080 feet, or 0.115 of an ordinary mile, then this estimate is too large, being approximately 29,000 miles. But if Pliny is correct in stating that Eratosthenes was employing a stadium of which 40 made one Egyptian *schoinos*, equal in its turn to 12,000 royal cubits of 0.525 meters, then, indeed, the estimate has the incredibly excellent value of 24,662 miles, just 200 miles less than its true meridional value.

Such a close estimate must be regarded as purely accidental, however, since there are various sources of error in its computation. In the first place Syene was not exactly under the Tropic of Cancer. In fact its latitude is $24^{\circ} 5' 43''$, a difference amounting to a matter of around sixteen miles. A larger source of error, however, is found in the fact that the two places were not on the same meridian, Syene being nearly three degrees east of Alexandria.

If we assume the following latitudes and longitudes for the two places, namely, for Syene: $32^{\circ} 54' 30''$ E., $24^{\circ} 5' 30''$ N., and for Alexandria: $29^{\circ} 58' 30''$ E., $31^{\circ} 13' 5''$ N., then an easy calculation shows that the great-circle distance between them is $7^{\circ} 35'$, or a matter of 4,550 standard stadia. Hence, unless we accept the statement of Pliny and modify the measure itself, we see that the estimated distance was greatly in error. On the other hand, the measurement of the sun's altitude was surprisingly accurate, since one-fiftieth of a great circle is approximately $7^{\circ} 12'$, whereas the difference in latitude was actually about $7^{\circ} 7\frac{1}{2}'$, an error of $4\frac{1}{2}'$. These estimates are not the least of the surprising things found in the golden city.

4. *The Foundations of Scientific Geography.*

Having thus attained a reasonably accurate estimate of this fundamental measure, Eratosthenes then proceeded to lay out the foundations for a scientific theory of geography. This required, of course, a *prime*

meridian, which he naturally established through Alexandria. Hence, in the beginning, it was not Greenwich, but Alexandria, from which locations east and west were made. This prime meridian, as we have seen, was supposed to pass through Syene and along the course of the Nile through the land of the Nubians to the country of the Sembridae, who were supposed to live on the edge of the known world. Northward from Alexandria it passed through Rhodes, an error of about a degree and a half in magnitude, thence through the Euxine sea to the mouth of the Borysthenes river (Dneiper), an error of three degrees.

For his primary parallel Eratosthenes took a line through Rhodes, which, running through the Malea Promontory of the Grecian Peloponnesus, touched westward the toe of Italy, passed through the Strait of the Columns (Gibraltar), and thence to the Sacred Promontory (Cape St. Vincent), which was at that time believed, though erroneously, to be the most westerly point of Europe. Eastward from Rhodes the line passed through the Gulf of Issus and thence along the southern base of the Taurus Mountains, then regarded as forming a vast barrier across Asia. This line, like the other, was considerably in error and created noticeable distortion in the mapping of Mediterranean countries. For example, if we assume that the parallel intended was that of 36° , which passes through the Straits of Gibraltar, then the Sacred Promontory was brought about a degree too far south, while the toe of Italy is approximately three degrees in error, being placed near the island of Malta. On the other hand the line passes within less than a half degree of Cape Malea, about 25 miles south of the city of Rhodes, and the same distance from the Gulf of Issus.

That Eratosthenes had a very clear idea in general of the possibilities which were opened up by extending his parallel beyond the known limits of the habited world is shown by the following quotation from Strabo:¹

“Again, attempting still further to appease us by saying that it is ‘in accordance with nature’ to call the distance from east to west greater, he says it is ‘in accordance with nature’ that from the east

¹ i, 4, 6.

to the west the inhabited world is longer, and, 'just as I have already stated in the manner of the mathematicians,' he says, 'it forms a complete circle, itself meeting itself; so that, if the immensity of the Atlantic Sea did not prevent, we could sail from Iberia to India along one and the same parallel over the remainder of the circle.'"

Here, indeed, appears to be the first indication that the world could be circumnavigated, a dream that was not to be fulfilled for eighteen centuries. So far do the visions of science sometimes precede their accomplishment!

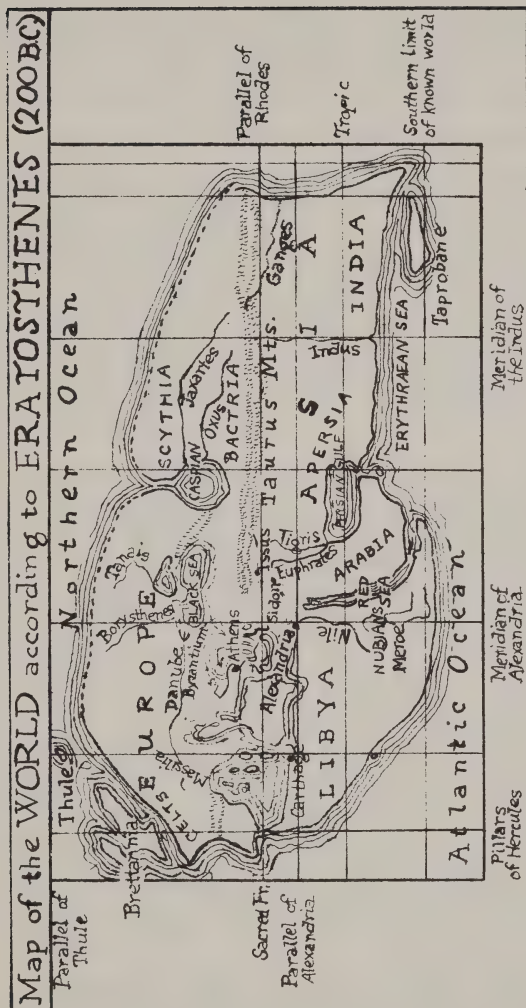
As for the north and south extensions of his principal meridian, Eratosthenes naturally had very slight acquaintance. The most northerly point he accepted as the island of Thule, which lies on the edge of the frozen sea. This place had been reported by Pytheas, a native of Massilia. His circle of parallel through this island he places at a distance of 11,500 stadia from the mouth of the river Borysthenes.

The mysterious island of Thule has never been fully identified and Strabo rejected its existence altogether. Pliny¹, quoting Pytheas, says that Thule is six days' sail from the north of Britain and has a day six months in length and a night of equal duration. However this may be, the name *Ultima Thule* has come down in language to mean a remote and mysterious land. For example, we find in Poe's *Dream-land* the following passage:

"By a route obscure and lonely,
 Haunted by ill angels only,
 Where an Eidolon, named Night,
 On a black throne reigns upright,
 I have reached these lands but newly
 From an ultimate dim Thule —
 From a wild weird clime that lieth, sublime
 Out of SPACE — out of TIME."

To the southward, as we have said, the meridian line extended into the heart of Africa, which was completely unknown in that day and which was regarded as too hot to be inhabited. As to what remained in the tropics there is scanty speculation. We find in Strabo, on this intriguing question, only the one statement:²

¹ ii, 77. ² ii, 5, 13.



Eratosthenes, by his clear Perception of the Problem, Laid the
Foundations of Scientific Geography.

“But to give an accurate account of the whole earth and of the whole ‘spinning whorl’ [by this Strabo means approximately a truncated cone] of the zone of which I was speaking is the function of another science – for instance, take the question whether the ‘spinning-whorl’ is inhabited in its other fourth also. And, indeed, if it is inhabited, it is not inhabited by men such as exist in our fourth, and we should have to regard it as another inhabited world.”

5. *The Voyages of Eudoxus.*

It is curious that these speculations about the character of the world and the unknown lands and people that might lie beyond the known boundaries of inhabited countries should not have struck fire in the imagination of adventurers. But there appears to have been little in the way of expeditions as we know them today. A notable exception is to be observed in the voyages of Eudoxus of Cyzicus, which were related by Posidonius as evidence that Africa could be circumnavigated.¹

It seems that Eudoxus came to Alexandria during the reign of Ptolemy Euergetes II (Physkon) as an ambassador from Cyzicus. Being a man of adventurous and imaginative character he became associated with the king and the king's ministers in voyages up the Nile. While he was in Alexandria an Indian sailor was brought to the king by the coast-guards of the Arabian Gulf, who said that they had found him half-dead and apparently the sole survivor of a shipwreck. Since the man knew no Greek and could not relate the story of his adventures he was placed in charge of tutors, who instructed him in that language. Thus, in the course of time, the sailor was able to tell his story, which was to the effect that he had sailed from India, but that his companions had all died from starvation on the way. In order to support his story he offered to act as a guide to India if the king would fit up an expedition.

Eudoxus apparently was made commander of this expedition and in time he returned with a cargo of perfumes and precious stones. But as one may well imagine from the character of Ptolemy Physkon, he was not allowed to enjoy the fruits of his adventure, for the king appropriated his entire cargo.

¹ Strabo, ii, 3, 4-5.

After the death of the ruler, however, Eudoxus was persuaded by Cleopatra, his successor, to undertake a second expedition. On his return, driven from his course by contrary winds, he came to the African coast, where he was well treated by the natives. From them he received a curious present in the form of the prow of a ship, carved in the shape of a horse's head, which he was told came from a wrecked vessel that had sailed from the western ocean.

In the course of time Eudoxus again reached Alexandria; but once more the adventurer was despoiled of his cargo, this time by Ptolemy, Soter II, who was then the ruler of Egypt. Exhibiting the ship's prow in the market place, Eudoxus was informed by the shipmasters that this figure-head was used by some of the ships sailing from Gades (Cadiz) in the south of Spain. Some, indeed, claimed that they recognized this particular prow as belonging to one of the vessels which had sailed around the coast of Maurusia in northern Africa and had not been heard from again.

Influenced by these stories, Eudoxus reached the conclusion that it was possible to circumnavigate Africa. Having by this time had enough of the honor of the Ptolemies, he returned to his home and fitted out a new vessel in which he sailed to Gades, announcing along the way the adventure which he proposed to undertake. Apparently he secured enough money to build a large ship and two smaller tenders, which he equipped for a long voyage. He then set out again for India, but this time around the western coast of Africa. Favored by constantly westerly breezes he sailed a considerable distance southward. His companions, however, finally tired of the voyage and Eudoxus was forced to turn back toward land where his ship ran aground. He managed, however, to rescue all his stores and most of the ship's timbers from which he built another vessel and continued the voyage.

How far he went we do not know, but apparently he became discouraged from the great distance and turned back to Maurusia. There he went to the court of King Bogus and tried to persuade this monarch to fit out an adequate expedition. But the advisers of the king pointed out the dangers of invasion that might come upon him if such a route were actually to be found and Eudoxus was forced to flee for his life.

The intrepid adventurer finally reached Spain, however, and succeeded in fitting out two more ships for another voyage. But here the story of Posidonius ends for Eudoxus sailed away to seek the southern passage to India and was never heard from again. But from these things, concludes Posidonius, it becomes clear that the ocean flows in a circle around the inhabited world:

“And there along the continental strands
In boundless flood it pours its crystal stream.”

6. *The Geography of Strabo.*

Although the pioneer work of Eratosthenes in geography was sufficient to insure the development of a subject so vital to the interests of mankind, it is obvious that its imperfections must soon have challenged the attention of his successors. Although to give any detailed account of the slow progress of knowledge in geography exceeds our province, it will be instructive to review cursorily the work of a few of the writers who followed Eratosthenes.

Among the most important geographers of ancient times was Strabo, who flourished during the whole of the reign of the Roman emperor Augustus (31 B. C. to 14 A. D.) and the early part of that of Emperor Tiberius (14 to 37 A. D.). His great work on *Geography*, written in seventeen books, was completed not earlier than 19 A. D. and furnishes us with a systematic account of the subject as it existed at the beginning of the Christian era.

Although Strabo was a native of Amasia in Pontus, where he was born about 63 B. C., he traveled extensively over the known world and was familiar with many of the places which he describes. He himself boasts: “I have traveled westward from Armenia as far as the coasts of Tyrrhenia opposite Sardinia, and in the direction of the South I have traveled from the Euxine Sea as far as the frontiers of Ethiopia. And you could not find another person among the writers on Geography who has traveled over more of the distances just mentioned than I; indeed, those who have traveled more than I in the western regions have not covered as much ground in the east, and those who have traveled more in the eastern countries are behind me in the western countries; and the same holds true in regard to the regions toward the South and North.” But in spite of these extensive travels,

Strabo failed to visit many important places in the Mediterranean world. He saw Cyrene from the sea, but did not stop over in this important city.

It is interesting to observe that Strabo spent considerable time in Alexandria; and while he sojourned in Egypt he accompanied Aelius Gallus, the Roman prefect, on a voyage up the Nile as far as Syene and Philae around the year 24 B. C. It is quite probable that much of the material in his *Geography* was derived from the books in the Museum in Alexandria. Our own fairly detailed knowledge about the golden city itself is derived in large part from the seventeenth book of Strabo's treatise. He relied very greatly upon the geographical writings of his predecessors, — Eratosthenes, Polybius, Posidonius, and Theophanes of Mitylene.

Of the seventeen books of the *Geography* of Strabo, two are introductory, eight are devoted to Europe, one to the main divisions of Asia, three to Asia Minor, one to India and Persia, another to Syria, Babylonia, Assyria, and Arabia, and the final book to Egypt and Africa. In spite of its blemishes the treatise of Strabo is without doubt the greatest work on the subject produced by any Greek or Roman author. It is a treasure-house of information about the lands, peoples, cities, and countries of the ancient world, some of which have completely disappeared in modern times.

7. *Polybius, the Historian.*

Of the predecessors of Strabo, other than Eratosthenes, the greatest are Posidonius and Polybius. Of the notable contributions of Posidonius we shall speak in detail in another chapter. But with Polybius we should become acquainted at this time for our debt to him in the composition of these chronicles has been made evident already in a number of places.

Although Polybius was essentially an historian, he contributed also in an essential manner to the knowledge of geography. Polybius was born about 204 B. C. in Megalopolis in Arcadia, which forms the central plateau of the Greek Peloponnesus. Since he died in 122 B. C. his life stretches across nearly a century of one of the most interesting periods of history, — from the beginning of the reign of Ptolemy V, (Epiphanes), to about the end of the reign of Ptolemy IX, (Physkon).

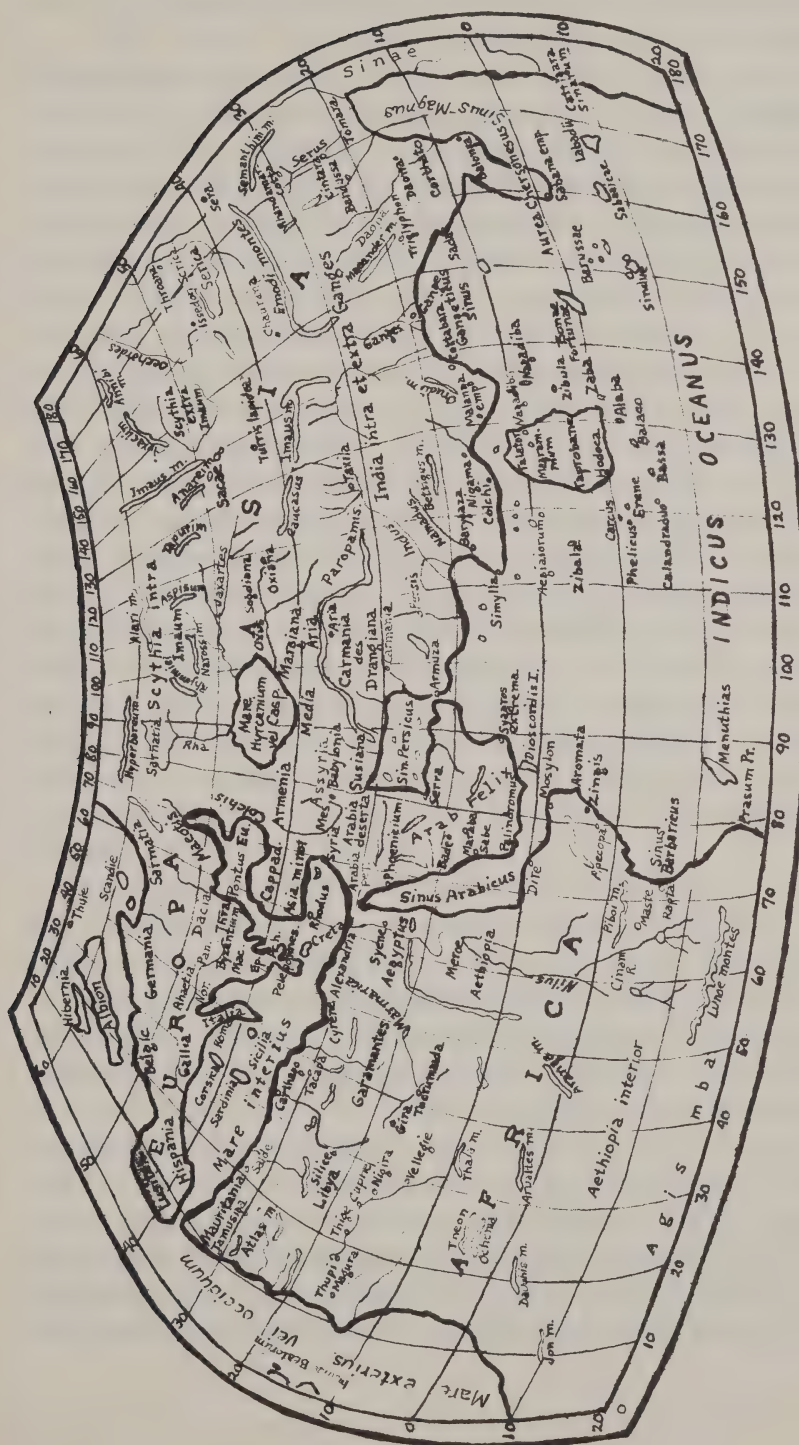
Most of our information about the historical developments of this time comes from the lucid pages of his *History*.

Polybius was the son of Lycortas, who in 182 B. C. became the leader of the famous Achaean League, a confederation of the ancient cities along the Corinthian Gulf formed for their mutual protection against the pirates of that region and the predatory nations in their neighborhood. Thus Polybius, from his earliest years, had an intimate contact with most of the important political leaders of the period in which he lived. In connection with our history of Alexandria it is interesting to observe that in 181 B. C., despite his youth, Polybius was appointed a member of an embassy sent to the golden city to visit Ptolemy Epiphanes. Unfortunately this trip was terminated by the sudden death of the king.

After the second Macedonian War and the defeat of the Achaean League by the Romans, Polybius was sent in 167 B. C. as one of the hostages to Rome, where he lived for seventeen years. He enjoyed a close personal friendship with L. Aemilius Paullus, the conqueror of Macedonia, and his two sons, Scipio and Fabius, of whom he became the teacher. With Scipio, in particular, he formed a life-long friendship and accompanied him to Carthage where he witnessed in 147 B. C. the destruction of that city.

During this turbulent period in human affairs, the Achaean League had made one last desperate stand against the force of Roman arms. But the heroic efforts of the Greek cities availed them naught against the mighty forces of the Roman Republic. Polybius returned to Greece in 146 B. C., where he found Corinth in ruins and the plight of the Achaean cities desperate. His heart was heavy when he witnessed the "contempt of the soldiers for works of art and votive offerings. He says he was present himself and saw pictures thrown on the ground and soldiers playing draughts upon them."¹ But through his personal efforts and his influence at Rome, Polybius was able to stay these forces of destruction, and save his fellow citizens from the worst effects of their folly. At the invitation of the Romans, Polybius was appointed as the ambassador charged with reconciling his countrymen to the new regime. This difficult task he appears to have ac-

¹ Strabo, vii, 6, 28.



The Map of the World as Prepared by Claudius Ptolemy Around the Year 150 A. D.

complished to the satisfaction of both sides, and a statue was erected in his honor by the grateful Greeks.

The remainder of the life of Polybius was devoted to the task of writing his great *History* in forty books, of which only a part is now extant. This work was undertaken to explain "the how, when, and wherefore of the subjection of the known parts of the world to the domination of Rome," — a conquest which occupied a period of fifty-three years. This monumental work of Polybius, ending in 146 B. C., inspired Strabo in a later age, and the geographer is known to have written an extensive treatise called *Historical Memoirs* in forty-three books, which was designed to continue down to his own times the narrative of Polybius. Unfortunately this *magnum opus* is now lost.

Although the importance of Polybius resides primarily in his ability as an historian, nevertheless he was the first writer to indicate the significance of geography in the interpretation of political events. So important did this appear to Polybius that he devoted an entire book, the thirty-fourth, to this subject. Although the material belongs unfortunately to one of the lost books, many commentaries about it remain and we are able to judge its nature. In addition to his record of customs and places, Polybius devoted particular attention to the estimation of distances between points in the Mediterranean region and indicated how far this measurement had progressed since the time of Eratosthenes.

8. *The Map of Claudius Ptolemy.*

The last great geographer of antiquity was Claudius Ptolemy, the astronomer, whose life and work we shall survey in more detail in another chapter. Ptolemy, who flourished around 150 A. D., wrote an extensive treatise on geography in eight books, which exerted almost as much influence upon the succeeding centuries as did his celebrated astronomical work, the *Almagest*.

The principal object of Ptolemy was to provide an adequate representation of the known places on the surface of the earth. As an astronomer he knew that the only scientific method to pursue in this regard was that suggested both by Eratosthenes and by Hipparchus several centuries earlier, namely, the location of important terrestrial objects by some system of coordinates. Apparently Ptolemy was pre-

ceded in his work by Marinus of Tyre, who flourished about 120 A. D., but whose writing is unknown to us except through the references given by Ptolemy himself.

The map provided by Ptolemy was a considerable improvement over that of Eratosthenes, as one might readily expect from the increased knowledge about the Mediterranean world that had accumulated during four centuries. In particular, he possessed much better estimates of some of the critical distances. In two important matters, however, Ptolemy fell short of the work of his distinguished predecessor. In the first place, he had adopted the value of the circumference of the earth determined by Posidonius, namely, 180,000 stadia, which was considerably more than 4,000 miles too small. This made every degree of longitude or latitude (measured at the equator) equal to 500 stadia, instead of its true value of 600 stadia (69 miles). In the second place, Ptolemy took as his prime meridian a line passing through a supposed island located $2\frac{1}{2}^{\circ}$ west of the Sacred Promontory, which was then regarded as the most westerly point of Europe. Since the latitudes and longitudes given by Ptolemy were actually determined at Alexandria, it was inconvenient, to say the least, to have a prime meridian so inaccessibly placed. Of course Ptolemy, himself, would have argued that the location of the reference meridian at a point beyond the most westerly point in Europe avoided the disadvantage of distinguishing between east and west latitudes throughout the known inhabitable world.

The greatest improvement adopted by Ptolemy in his *Geography* was the introduction of a scheme of projection by which he could represent scientifically upon a plane map the positions of places actually located upon the spherical surface of the earth. Although the imperfect observations of his day vitiated the importance of this scientific refinement, Ptolemy set the standard in this regard for modern maps and his methods differ little from those employed by the cartographers of our own time.

The treatise of Ptolemy was accompanied by maps, although when these were actually prepared is not certain. In two of the most ancient manuscripts which we possess the statement is made that a certain Agathodaemon of Alexandria "drew them according to the eight books of Claudius Ptolemy." But whether Agathodaemon was a contemporary

of the astronomer and prepared the maps under the eye of the master, or whether he was a cartographer of a later day is not known.

And thus we see again that the scholars of the Alexandrian Museum had projected their imaginations far beyond the knowledge of their own time. The great sphere of the earth was clearly perceived by them, and all that was known of place and distance had been mapped upon its surface. But mankind itself was not yet prepared to follow up their vision, since more than thirteen centuries elapsed before the intrepid Columbus, embarking in his three small caravels, dared to test the theories of the ancient Alexandrians and sail westward to the wonders of Cathay.

How imperfectly Columbus had learned the lesson, how little he appreciated the measurements of Eratosthenes and the astronomers of the Museum, is attested by his letter to the Treasurer of Aragon in 1493:

“As I know you will be rejoiced at the glorious success that our Lord has given me in my voyage, I write this to tell you how in thirty-three days I sailed to the Indies with the fleet that the illustrious King and Queen, our Sovereigns, gave me, where I discovered many islands, inhabited by numberless people... When I came to Juana, I followed the coast of that isle toward the west, and found it so extensive that I thought it might be the mainland, the province of Cathay.”

It is inconceivable that Columbus would have fallen into the error of believing that he had reached India, after a voyage of 33 days, had he made the most casual inspection of the map of Ptolemy. The Ganges river, according to the Alexandrians, was about 140° east from the most westerly point of the Spanish peninsula. Although this is an over-estimate of some 40° , even the crudest approximation based upon the size of the earth as given by Ptolemy would have shown that a voyage of 33 days into the Western Ocean would fall incredibly short of carrying one to the magic lands of the orient.

CHAPTER 8

A DAY IN HERO'S HOUSE

1. *The Mysterious Ctesibius*

HERE IS A PASSAGE IN Athenaeus which runs as follows¹:
“And Hedylus in his *Epigrams*, mentioning the rhyton [pitcher] made by the engineer Ctesibius, says: ‘Come hither, ye drinkers of strong wine, look also at the rhyton in the temple of Arsinoë the Gracious, the lover of the West Wind; it is in the form of the Egyptian Desas, the dancer, who trumpets forth a shrill note when the spout is opened for the flowing wine – no signal for battle is this, but through the golden mouthpiece there rings the signal for reveling and mirth; it is like the ancestral melody which the Lord Nile produced from the divine waters, dear to the initiates who bring him their offerings. Nay then, if ye will honor this clever device of Ctesibius, come hither, young men, beside the temple of Arsinoë here.’”

And there is another section in the work of the same author which says²:

“And yet that instrument, the water-organ, whether belonging to the class of string or wind instruments, as you choose, is the invention of one of our own Alexandrians, a barber by trade; and his name is Ctesibius. Aristocles relates this, speaking in some such fashion as this in his work *On Choruses*: ‘The question is debated whether the water-organ belongs to the wind or the stringed instruments. Now Aristoxenus, to be sure, does not know it; but it is said that Plato imparted a slight hint of its construction in having made a time-piece for use at night which resembled a water-organ, being a very large water-clock. And in fact the water-organ does look like a water-clock. Therefore it cannot be regarded as a stringed instrument or a percussion instrument, but perhaps may be described as a wind instrument, since wind is forced into it by the water. For the pipes are set low in water, and as the water is briskly agitated by a boy, air is released

¹ *Deipnosophistae*, xi, 497. ² *Ibid.*, iv, 174.

in the pipes through certain valves which fit into the pipes from one side of the organ to the other, and a pleasant sound is produced. The organ is shaped like a round altar, and it is said to have been invented by Ctesibius, a barber who lived there in Aspendia during the reign of Ptolemy Euergetes II; and they say that he became very famous; he, indeed, even taught his wife Thais.' Tryphon, in the third book *On the Use of Terms* (the treatise which has to do with pipes and instruments), says that Ctesibius the engineer wrote an account of the water-organ. I am not sure whether he is mistaken in the name."

In yet another place Athenaeus says:¹

"Ctesibius of Chalcis, the friend of Menedemus, was once asked by somebody, according to Antigonus of Carystus in *Lives*, what advantage he had gained from philosophy. He replied: 'Dinners without paying my share.'"

Now these passages have caused much speculation among historians of science since here, through the dim curtain of the past, we catch the first glimpse of a technological genius among the Alexandrian sages. But how many faces do we see there? Is Ctesibius the philosopher, who must have lived in the reign of Philadelphus, the same Ctesibius who developed into the engineer? And were the rewards of his art so poor that he finally became the barber of the reign of Euergetes II?

This question would concern us little were it not for the fact that Hero of Alexandria, mathematician, engineer, and mechanic, has been called the pupil of Ctesibius as the result of a superscription on one of his works. It thus becomes a matter of considerable difficulty to locate the time in which Hero lived. This uncertainty is so great that estimates vary from 150 B. C., since Hero quotes a work on chords generally attributed to Hipparchus, who flourished around the middle of the second century B. C., and as late as 250 A. D., since he came before Pappus, who lived during the latter part of the third century of the Christian era.

Some authorities are inclined to assign Hero to the earlier period, although Sir Thomas Heath, whose jurisdiction over all matters per-

¹ *Deipnosophistae*, iv, 162.

taining to Greek mathematics is not to be lightly questioned, has advanced important reasons for assigning a date in the latter part of the first century A. D. The positive arguments given by Heath pertain to the use of certain Latinisms belonging to the Christian era, the description of an olive-press by Hero, the invention of which was ascribed by Pliny to a period not earlier than 55 A. D., and to an allusion by Plutarch, who died A. D. 120, to a theorem proved by Hero relating to the reflection of light.

But the unsettled state of the question leaves an historian free to place the object of his chronicle wherever he may choose. This strongly inclines one to the earliest possible date, for there is no doubt that the work of Hero was intimately related to that of Ctesibius, the masterly engineer of one of the Ptolemies. Since the story of these intriguing inventions has descended to us through the writings of Hero, and not through those of the master himself, history has quite properly assigned the name of the former to these works. But we must not be unmindful of the genius who originally gave them birth. He, we may be sure, belonged to the golden age of the Ptolemies and not to the period of the unimaginative Caesars.

Do we not look in vain in the accounts of the triumphs of the Roman emperors for a memorial float like that which Philadelphus exhibited to his subjects, — where the votary of Nysea arose from her throne and poured a libation to the gods? Would not such a spectacle have attracted the eyes of the Roman chroniclers? and would it not have been recorded in the effusions of the poets? How memorable would have been the triumph of Augustus could he have exhibited the image of Cleopatra alternately clasping the fatal asps to her bosom and extending them toward the multitude; or the triumph of Aurelian with a moving statue of Victory! But the ingenuity of the Ptolemies was never appreciated by those who followed. And the works of Ctesibius and his successor were allowed to be swallowed up in the press of other and far less important matters.

For this reason, therefore, we shall assume that Hero lived in Alexandria during the reign of Ptolemy Physkon (170-116), before that monster of iniquity had finally overwhelmed the work of his more enlightened founders of the dynasty, and while Hipparchus and his contemporaries were still at work in the great Museum.

2. We Visit Hero's Study.

Since history has denied us the details of Hero's workshop, we shall construct them from our imagination as they may quite probably have been according to the actual records that have been preserved for us by Hero himself. In this manner, though the method may offend the too meticulous historian, we may become more perfectly acquainted with both the spirit and the details of what was undoubtedly one of the most amazing developments of the golden city.

Therefore, on a bright afternoon somewhere around the year 150 B. C., let us leave the Museum and wander down a small street in its neighborhood. Our inquiries direct us to a spacious house and we are admitted somewhat grudgingly by a servant. He informs us that the master is greatly occupied and cannot be disturbed by visitors at this hour.

"He was working most of the night," says the servant, "for the gods would not yield him the answer to his problem. He has finally given in to nature, however, and is asleep."

At this discouraging news we prepare to depart; but at that moment an inner door flies open and an astonishing young man enters the room.

"In the name of Archimedes, I have found it!" he cries. "A plague upon those complicated gears. But the mystery is now solved. The gods at last have given me light."

His eyes now fall upon us and his enthusiasm gives way to inquiry. We inform him that we have come from the Museum and that his friends have persuaded us that the great engineer might be prevailed upon to show us the marvels of his workshop. We are apologetic, and desire to retire, since the problem on which he has been working must have made rest necessary.

"Nonsense," says Hero. "These problems too often intrude upon one's sleep. But the relaxation which follows the solution of one of them is better than a night's rest. I shall be only too glad to show you a few of my toys. Perhaps this very latest one will interest you."

We assure him of our delight although the solicitous servant does not appear to be too happy at our success. Hero leads us into a large and somewhat disorderly room.

"This is my study," says Hero. "Rather in disarray, I fear, but how can one bother too much with externals, when the internal problem is plaguing one's mind?"

The working table looked not unlike those of scholars of a later age. Several tablets covered with wax were visible among the litter of papyrus rolls which occupied most of the top of the table. Hero had evidently been making his calculations on these for they were covered with numerous symbols which he had formed with one of the stylus pencils lying close at hand. Two or three machine parts were also visible among the rolls. What interested us most, however, was the large sheet of papyrus which had been fastened to one edge of the table. Upon this there was beautifully drawn a diagram showing, apparently, the working part of some device to which the calculations of the wax tablets pertained. A reed pen had been used in making this drawing, guided, doubtless, by the straight-edge and the numerous discs of lead of varying diameters which formed part of the equipment of the artist. The ink, we were informed later, is derived from the cuttle fish and has very enduring qualities. Erasures are accomplished by means of a sponge, and the large piece of pumice stone beside the drawing is used to rub away the roughness of the papyrus before the actual work begins.

Along one edge of the room we observe a series of shelves on which are arranged neatly a number of rolls of papyrus. Some of these are very bulky and must contain, if our eyes estimate them correctly, as much as a hundred and fifty feet of paper. Beside the rolls there are a number of models of the machines which we are to see later in the workshop.

Upon the top of the row of shelves stand several beautiful bronze busts, prominent among which are the heads and shoulders of three men. The artist who modeled them has caught the spirit of the originals, for one is left in no doubt that he looks upon the images of thinkers.

"You see the gods of my little shrine," says Hero, noticing our interest in these three figures. "Let those who wish give worship to Dionysus, or to Apollo, or to our venerated Serapis, but I bow down in thankfulness each day that the divine spark has been given to my deities."

At these unusual words we are consumed with curiosity and demand an explanation from our host.

"The first of my deities is Archimedes," says Hero. "For who in all the world has given us so much to think about? Not only was he able to mold the intractable iron to his will, but he has seen other things in nature with the eyes of the mind alone. The second is the great Ctesibius, who laid the foundation for all the things that I shall show you. He has been dead these many years, but I have fallen heir

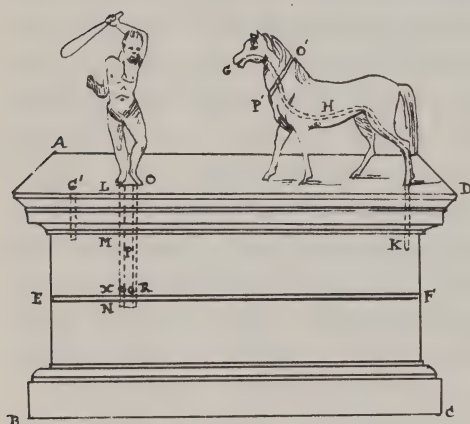


Figure 1.

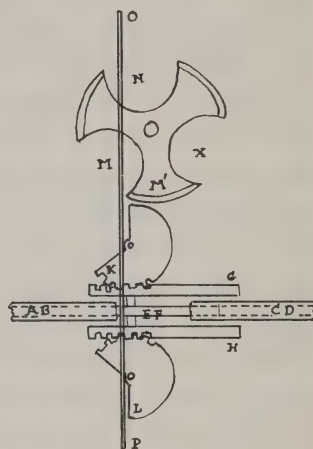


Figure 2.

to his workshop. He was much honored by the kings and his memory sustains me now in my dealings with the court. The third is Philo of Byzantium. See for yourself what genius the man possessed! Can one doubt that Ctesibius himself regarded Philo as the master?"

And even as Hero spoke he pulled down from the shelves a great roll of papyrus and spread it eagerly before us. "Here is the marvelous *Mechanica Syntaxis* of Philo, the source of much of our knowledge about mechanics," says Hero, rapidly unrolling the bulky treatise. "Look upon these drawings of the great war engines, which Philo made to use the magic power of air in discharging stones and arrows. Even the kings are interested in these matters."

We examine very eagerly this weighty work, which proves once more that science flourishes in times of war as the needs of rulers

force them to employ the ingenuity of their cleverest subjects. Even the great Archimedes had been one of the most notable defenders of the walls of Syracuse. And perhaps one may make the cynical observation that of the treatise of Philo there is extant only that portion of the work which tells of missiles, the construction of fortresses, and the methods used in provisioning, attacking, and defending them.

3. *The Puzzle of the Decapitation of the Horse.*

We turn our attention next to the drawing on the table. What we see there is the picture of a horse and a brawny giant threatening it with a club. We turn to Hero for an explanation.

"That has been the cause of all my trouble," says our host. "A few days ago I was summoned to the palace of the dioketes, who wishes me to construct a device for the amusement of his guests at a banquet that he proposes to give soon in honor of the king. He has asked me to make the image of a horse, so fashioned that the animal will drink water out of a bowl when the giant, whom you see, is turned toward him. That I can readily do. But the baffling problem hinges on another matter. You note the line across the neck of the horse. It seems that the dioketes made a wager that he could produce an animal whose head could not be severed even though a knife is run completely through this line in its neck. Moreover, he wants the horse to drink water just as usual after the operation."

We express our incredulity and assure Hero that the dioketes will surely lose his wager.

"That must not be," says Hero, "for I shall be paid very well if I can produce this magical animal. But the puzzle is finally solved, although it has kept me sleepless for many hours. Let me show you how the matter is to be accomplished."

Pointing to the box on which the figures were represented as standing (Figure 1), Hero continued: "You see this line EF which represents a partition across the middle part of the air-tight pedestal ABCD. The upper portion is filled with water, but the lower portion is left empty. We now insert the tube LMN through the upper part of the box and let its lower end pass through the partition. Within this tube we fix another one, OP, which fits it closely, and this is attached to the image of the man with the club. Now you will see the two cor-

responding holes, X and R, one in the outer tube and the other in the inner. When the giant is turned toward the horse these holes will come into coincidence and the water will then run out of the upper compartment and into the lower. As it thus withdraws a vacuum will be created in the upper part of the box and this in turn will allow the horse to suck water out of the bowl presented to its mouth through the tube GPHK."

We are much intrigued by this simple solution of what looked at first like one of great difficulty. But the other impossibility still remains. How, indeed, can the head of the animal be kept in place after the severing knife has passed through the neck? And how, we wonder, can the creature drink after so strenuous an operation? Hero's face lights up with excitement and he begins busily to draw a figure on one of the waxen tablets.

"I left the poor dioketes wringing his hands the other day," he says, "for I did not then see the answer to the puzzle; but here it is at last. Look you upon this diagram! (Figure 2) Note first the axle-like figure at the top. Fixed to a pivot beyond the severing line, which I have indicated with the letters OP, the entire wheel will revolve in a groove fastened in the horse's head. The outer edge of this device is thickened so that any one of the three parts will hold the head of the animal against the neck. If a knife is run through the line OP, thus moving one part of the wheel, another will come into place and prevent the decapitation of the horse. As the knife moves lower it will then encounter part of a cylinder which is so toothed that when it moves it will draw the connecting tube EF out of the fixed tube AB. Beneath this there is a similar cylinder, but so cut that when the knife encounters it, the tube EF will then be reinserted in the fixed tube AB. Hence, the animal has come through his ordeal unscathed and will obediently drink his water when the giant threatens him with the club."

We are duly astonished at this ingenious device and congratulate Hero upon what will surely prove to be the triumph of the dioketes.

4. Wine from the Miraculous Pitchers.

"Before we go into the workshop," says Hero, "it may be instructive for you to learn about the mysteries of the vacuum, which

is used in many of my toys. But since the story is a dry one, perhaps a little wine will lighten the telling of it."

We concur in this and our host, stepping to the wall, pushes aside a panel which conceals a small cupboard. We see in this an array of goblets together with several pitchers and jars of varying shapes and sizes. Hero takes one of the latter, a rather large spherical vessel with an ornamental top, which rests upon a square base from which a pipe protrudes. To this pipe there has been fixed a rod of iron, which acts as a lever for turning the pipe, and is balanced by a heavy weight below. To the upper portion of the rod there is attached a cup in the form of a truncated cone, into which balls of various diameters can be dropped.

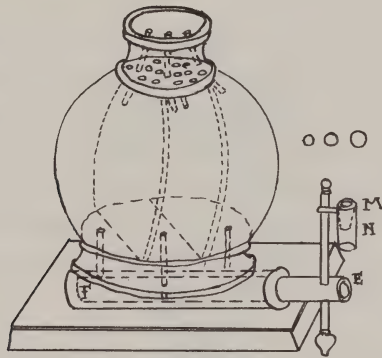


Figure 3.

"I don't know what wine you desire," says Hero, "but I have in this jar several rare vintages. One is a very old Chalybonian from Syria, another is from the famous vines of the Caecuban Plain, brought recently to me by a friend from Italy, and the last is a product of our own Mareotis."

We each select a different wine, whereupon Hero drops a lead ball into the conical cup of his vessel (MN of Figure 3). This turns the pipe through a certain angle and a rich red wine flows from the spigot. When the goblet is full, the ball is removed and the flow stops. Another ball, this time of different size, is dropped into the cup, and to our surprise a white wine is now delivered from the vessel. And finally, we express our genuine astonishment when a third ball, differing in size from the other two, causes a third kind of wine to flow from the pipe. Hero explains to us that the jar contains three different

compartments, which are filled separately by a pneumatic device in the top of the vessel. The different wines are then separately drawn off by turning the bottom pipe (EF) through angles which bring successively into coincidence holes bored in the pipe and in the bottoms of the three compartments. The balls of different sizes are so fashioned that their weights are just sufficient to turn the pipe through the angles necessary to cause the flow of the proper wine.

"I have specialized in various kinds of pitchers," says Hero, as we sip the delicious beverages. "Here, for example, is a very useful one, for when it is tilted it will discharge from its mouth only enough wine to fill a goblet and no more. If a second goblet is desired, the pitcher must be held upright for a moment before it is again tilted.

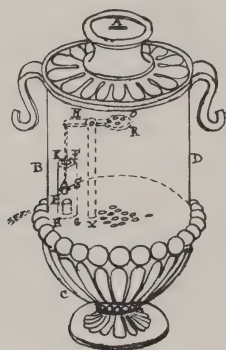


Figure 4.

And here is yet another which gives amusement to many. Note that a pretty sound is emitted when I pour from it. This flagon is very simply constructed, for I have merely inserted two tubes through the partition which seals the bowl from the neck. By means of the longer of these the wine flows out into the goblet; but since the end of the shorter opens only into the neck, the liquid remains there forcing air out through this whistle in the diaphragm that forms the top."

Hero now brings forth from his cabinet another device which he shows to us with great pleasure (Figure 4). It is a cylindrical vessel with a small slot in the top and a pipe for the discharge of liquid near the bottom. "This has been quite a profitable invention for me," says Hero, "for it has been placed in most of the temples. You will

observe that this opening in the top is large enough for the insertion of a coin of five drachmas. Let me show you how it works."

Thereupon our host inserts a coin in the slot and in a moment a stream of water issues from the pipe. After flowing a few moments the water automatically shuts off.

"This device is used by those who wish sacred water in paying honor to the gods," says Hero. "The money is later used in giving alms to the poor, — or at least, that is what I hope."

To those of us who live so many centuries after the great inventor of Alexandria, the simple device of Hero may not excite our interest, since now its progeny are seen on every hand. For this was the prototype of the modern slot-machine.

5. *A Discourse on the Mysteries of the Vacuum.*

"These devices of mine," says Hero, "proceed for the most part from a single principle, that of the vacuum. Let me read you a portion of a book which I have begun on the subject. It explains, perhaps, most clearly what I now think about the subject."

Thereupon, Hero picks up a papyrus roll, and while we recline comfortably on our couches, sipping the rare old wine, our host begins as follows:¹

"Some assert that there is absolutely no vacuum; others that, while no continuous vacuum is exhibited in nature, it is to be found distributed in minute portions through air, water, fire, and all other substances; and this latter opinion, which we will presently demonstrate to be true from sensible phenomena, we adopt. Vessels which seem to most men to be empty, are not empty, as they suppose, but full of air. Now the air, as those who have treated of physics are agreed, is composed of particles minute and light and, for the most part, invisible. If, then, we pour water into an apparently empty vessel, air will leave the vessel proportioned in quantity to the water which enters it. This may be seen from the following experiment. Let the vessel which seems to be empty be inverted, and, being carefully kept upright, pressed down into the water; the water will not enter it even though it be entirely immersed; so that it is manifest that the air, being matter, and having itself filled all the space in the vessel,

¹ From the introduction of Hero's *Treatise on Pneumatics*.

does not allow the water to enter. Now, if we bore the bottom of the vessel, the water will enter through the mouth, but the air will escape through the hole. Again, if, before perforating the bottom, we raise the vessel vertically, and turn it up, we shall find the inner surface of the vessel entirely free from moisture, exactly as it was before immersion. Hence it must be assumed that the air is matter.

“The air when set in motion becomes wind..., and if, when the bottom of the vessel had been pierced and the water is entering, we place the hand over the hole, we shall feel the wind escaping from the vessel; and this is nothing else but air, which is being driven out by water. It is not to be supposed then that there exists in nature a distinct and continuous vacuum, but that it is distributed in small measure through air and liquid and all other bodies. Adamant alone might be thought not to partake of this quality, as it does not admit of fusion or fracture, and, when beaten against anvils or hammers, buries itself in them in its entirety. This peculiarity, however, is due to its excessive density; for the particles of fire, being coarser than the empty spaces in the stone, do not pass through them, but only touch the outer surface; consequently, as they do not penetrate into this, as into other substances, no heat results.

“The particles of air are in contact with each other, yet they do not fit closely in every part, but void spaces are left between them, as in the sand on the seashore; the grains of sand must be imagined to correspond to the particles of air, and the air between the grains of sand to the void spaces between the particles of air. Hence, when any force is applied to it, the air is compressed, and, contrary to its nature, falls into the vacant spaces from the pressure exerted on its particles; but when the force is withdrawn, the air returns to its former position from the elasticity of its particles, as is the case with horn shavings and the sponge, which, when compressed and set free again, return to the same position and exhibit the same bulk.

“Similarly, if from the application of force the particles of air be divided and a vacuum produced larger than is natural, the particles unite again afterwards; for bodies will have a rapid motion through a vacuum, where there is nothing to obstruct or repel them, until they are in contact. Thus, if a light vessel with a narrow mouth be taken and applied to the lips, and the air be sucked out and discharged, the vessel will be suspended from the lips, the vacuum drawing the flesh towards it that the exhausted space may be filled. It is manifest from this that there was a continuous vacuum in the vessel. The same

may be shown by means of the egg-shaped cups used by physicians, which are of glass, and have narrow mouths. When they wish to fill these with liquid, after sucking out the contained air, they place the finger on the vessel's mouth and invert them into the liquid; then the finger being withdrawn, the water is sucked up into the exhausted space, though the upward motion is against its nature."

Hero now puts down the roll from which he has been reading, and rises to his feet.

"I don't want to bore you too much with this theory, interesting and important though it is," he says, "for you will doubtless find the

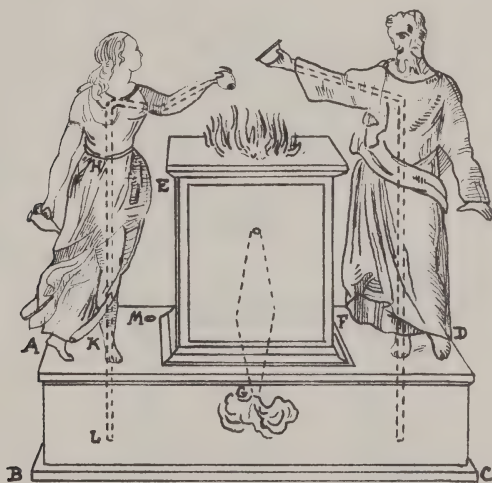


Figure 5.

working of it much more entertaining and instructive. Therefore, let us go into the workshop and see what we can find there to illustrate the principles which I have just been expounding."

6. *We Pour a Libation by Means of Fire.*

We agree to this with alacrity and follow our host. He leads us from the study into the court, which is a luxury enjoyed only by those of ample means, and across it into a commodious building attached to the remainder of the house by a corridor. As we enter the room we hear the sound of tools and we note that Hero must be doing a good business with his ingenious devices since he has several workmen in his employ. A forge stands at one end of the room, its fire blown

with a bellows. Near it an Egyptian is busily engaged in shaping glass into fancy ornaments. We are informed that this art has reached a high level in Alexandria, and that one of Hero's workmen is now perfecting a method for joining glass of different colors into a mosaic for the adornment of temple windows.

"Let us begin our inspection with this device," says Hero, indicating an altar on one side of which stands the figure of a woman and on the other the figure of a man (Figure 5). These two votaries hold in their outstretched hands vessels from which they appear to be pouring libations upon the altar.

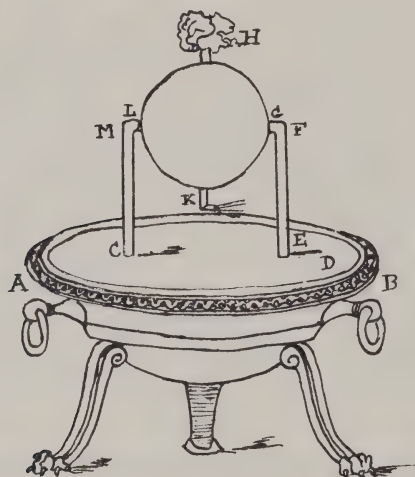


Figure 6.

"We shall now do honor to the god of this small shrine," says Hero. Whereupon he places some shavings upon the altar and lights them with a taper. In a few minutes we are astonished to see water flowing into the vessels held by the figures and thence upon the flame which is soon extinguished by the libations.

"You see here the power of fire," says Hero, his face glowing with enthusiasm. "The flame heats the air in the chamber below it, and this, when it expands, forces the water in the base of the altar upward through tubes concealed in these figures. Thus it is that we are able to pour our libation to the god. One can scarcely imagine all that is possible with this miraculous force. Let me show you another example of it."

7. *The First Steam Engine.*

We eagerly follow Hero to a corner of his workshop and here he shows us with great pride a very unusual device which may be described as follows (Figure 6). A large cauldron with sealed cover is supported upon three legs, which lifts it sufficiently high above the ground so that a fire may be built beneath it. Two tubes (CM and EF) are mounted on the top of the cauldron and the extremities of these are bent so as to form a pivot for supporting a large hollow sphere. Through the diameter of this sphere and at right angles to the axis of the pivot, there is a pipe (HK) the extremities of which are bent in opposite directions. This pipe communicates with the interior of the sphere and the sphere in turn is connected with the interior of the cauldron by one of the two supporting pipes.

"Now observe what happens," says Hero, "when a fire is lighted under the cauldron."

Assisted by a workman, Hero now builds a fire beneath the device and after a while we witness the great miracle. For steam begins to pour forth from the pipes in the sphere of which we have spoken and in a few moments the ball rotates rapidly upon its axis.

And miracle, indeed, it is! For here in the ancient city of Alexandria we look upon the prototype of the first steam engine, which in later days was to revolutionize the entire world. But what was the cause of that lack of imagination, which should have seen the implications of this remarkable invention? Where was the genius who should have projected this child's toy into the great engines of commerce? Who was to blame for this tragedy of the race, which prevented the expansion of Hero's magnificent engine into a living vehicle to do the work of the toiling slaves? What tremendous human suffering might perhaps have been avoided could the rowers of the king's triremes have been replaced by the power of steam; or the toilsome treadmills made to give way to the power of the steam turbine which was here in Hero's grasp! Why was it necessary to wait until the end of the eighteenth century to find among the poets of science a passage comparable to the following words of Erasmus Darwin written in the year 1791?

“Soon shall thy arm, unconquered steam, afar
Drag the slow barge, or drive the rapid car;
Or on wide-waving wings expanded bear
The flying chariot through the fields of air.
Fair crews triumphant, leaning from above,
Shall wave their fluttering kerchiefs as they move
Or warrior bands alarm the gaping crowd,
And armies shrink beneath the shadowy cloud.”

These, indeed, should have been the words of Lucretius, the Roman poet, in the greatest scientific poem of antiquity: *De Rerum Natura* (Concerning the Nature of Things), and not the words of a poet writing eighteen centuries later. Shall we blame the persecutions of the hideous Physkon, who then ruled the destinies of the golden city? Or was it due to the fact that the human spirit was even then turning away from the inquiries instituted by the scholars of the Museum and toward the mysteries of the esoteric realm of the human soul? If one may guess on a matter now so distant, it is likely that the economic cause prevailed. For not until Spanish gold poured into Europe during the sixteenth century were these investigations of Hero and his colleagues once more taken up and carried onward to their magnificent development in modern times.

As soon as the fire has died down, and the turbine has finally come to rest, we move along to another part of this interesting shop.

8. Other Devices in the Workshop.

“Here is a device which has greatly interested the priests,” says Hero.

He now indicates to us a model which consists of an altar standing beside a small temple the interior of which is concealed from our eyes by a pair of folding doors. A small fire is now built upon the altar and to our great astonishment, after a short wait, the doors of the temple gradually begin to open and we are finally given a full view of the image of the god which sits within the shrine.

“Let me show you how it works,” says Hero picking up a wax tablet from a neighboring bench and sketching rapidly upon it. “Here you see is the altar (Figure 7), which is made air-tight. From it a tube (FH) runs into this ball partially filled with water which is then

made to pass into this bucket (MN) by the force of the expanding air as it heats up from the altar fire. As the bucket fills it gradually moves these rollers here and they open the doors of the temple."

But the experiment is not yet completed, for as soon as the fire dies down, we see that the doors begin to close and in a short time the image of the god is again concealed from our eyes. This is readily explained to us by our host. For as the air in the altar cools, a syphon

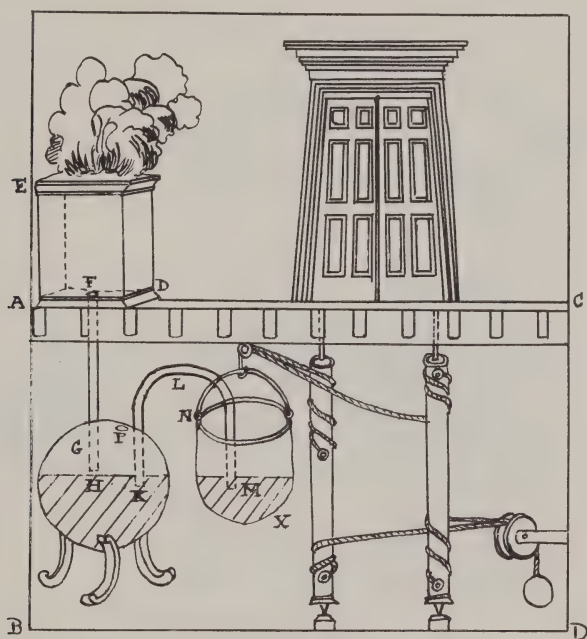


Figure 7.

is set up and the water in the bucket is sucked back once more into its spherical chamber. Thereupon a weight attached to the rollers once more turns them back into their place and the doors of the temple shut. But we may well wonder whether this ingenious inventor of Alexandria could himself really see the implications of this simple machine, the principle of which was actually used many centuries later in certain kinds of steam engines.

We follow Hero from one bench to another and on each of them there is some new and novel application of the principle which he had expounded to us in his study. In one device a stream of water falls from an ornamental fountain into a small basin and a bird in a neigh-

boring tree whistles to us. As a variant of this, another machine is so contrived that, although a stream of water runs perpetually from the fountain, the birds whistle for a while and then are mute, continuing their periods of song and silence as long as the water flows.

Another device, as clever as it is useful, attracts our attention. This is a lamp which trims its own wick as long as there is oil to keep it lighted. The mechanism of the contrivance is very simple for

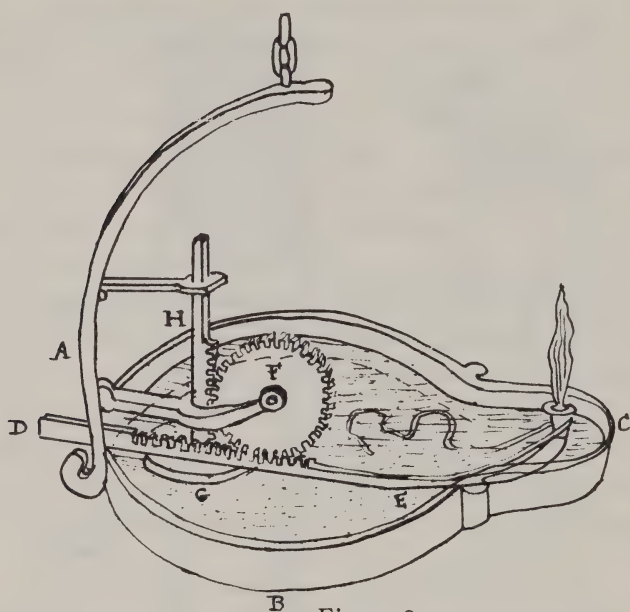


Figure 8.

it consists of a float (Figure 8) to which is attached a perpendicular bar with teeth which fit into the teeth of the wheel. When the float descends as the oil is consumed, the wheel moves a gear to keep the wick always above the level of the oil.

A toy garden is shown to us, which consists of a fountain made to trickle by the action of the rays of the sun. This consists merely of a ball filled nearly to the top with water and connected with a receiving basin by means of a bent syphon. As the rays of the sun heat the air in the top of the globe, water is forced out of the tube and into the basin.

9. *The Water Organ.*

"If you are fond of music," says Hero, "let me show you one of the most interesting and useful devices made in my workshop."

Thereupon our host takes us into an adjoining room which has been fitted up as a kind of chapel. At one end of this there is a small pipe organ with a keyboard not unlike those found in modern instruments.

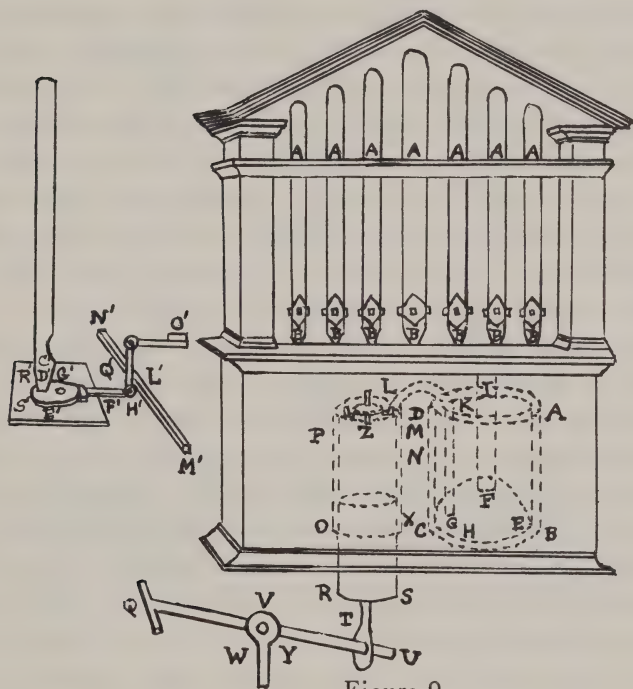


Figure 9.

Instructing one of us to man the pump-handle connected with the organ, Hero seats himself on a stool before the keyboard and in a moment the little hall is filled with a succession of very melodious sounds.

"This is the invention of Ctesibius, my great master," says Hero turning toward us again. "I have been attempting to improve it by means of a windmill which will work the pump and keep the instrument supplied with power. But, alas, the motion is not uniform and I have not yet hit upon any device which will remedy this fatal defect."

Since we have heard much in Alexandria of this famous invention of Ctesibius, the water organ, we ask Hero for an explanation of it and this he very graciously furnishes us from a drawing on papyrus which he has at hand in the workshop (Figure 9).

"If you will examine this diagram," he says, "you will first observe the air pump, PS, by means of which the air is made to enter the hollow hemisphere (GHE) in which it is stored. This tank we call the *pnigeus*, or throttle, and the pressure is kept uniform within it by the water which fills the cylindrical box (ABCD) that contains it. Since the hemisphere merely rests on the bottom of the box, the water is free to move into it whenever the pressure drops. The air from the *pnigeus*, you will observe, is introduced to the pipes through a connecting tube (IF). At the top of the pump, PS, there is a valve, which opens to admit air when the piston is withdrawn, but closes again as soon as the upward stroke has started. A similar valve opens and closes the tube (LKG) which leads to the *pnigeus*, and thus a supply of air may be stored for the operation of the organ.

"In the smaller diagram beside the instrument, I have shown the mechanics of the keyboard which controls the pipes. The vertical tube represents one of these reeds, and the plate (S'E'R'G') moves back and forth beneath it by means of the system of levers which you see on the right. When the hole, which one may observe in the plate, moves under the pipe, it allows air to flow from the chamber just below it. This chamber is connected with the *pnigeus*, as we have already described, and runs below the entire series of pipes. But when the hole is withdrawn, then the flow of air is shut off and the pipe is mute. The keys, which you have already seen, operate the plates and give us the different tones. When one of these is depressed, then the hole moves under its corresponding pipe and a sound is heard; but when the key is released, a spring, fashioned from a piece of horn, moves the hole back again and the sound is shut off."

Our admiration is unbounded at the ingenuity of the inventor of this ancient organ and one wonders whether engineers of modern times are any greater in their way than this remarkable technician in his way. That men in their perversity failed to follow him detracts nothing from the glory of his achievement. Rather, indeed, it sheds imperishable renown upon one who was actually so far ahead of his own times.

10. *A Fire is Extinguished in Alexandria.*

Since Hero now looks fatigued and the rays of the late afternoon sun are falling into the court yard, we thank our host and start again toward the Museum to recount the adventures which have befallen us. But we have not proceeded far when we notice a great concourse of people hastening down a side street. From them arise cries of

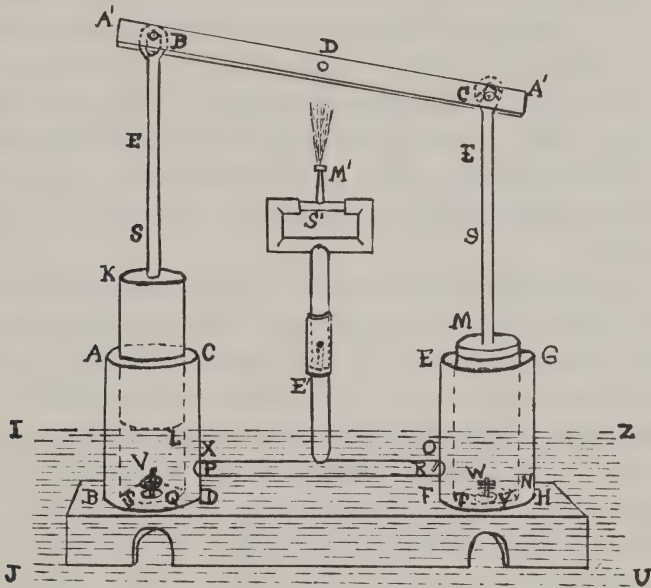


Figure 10.

"Fire! Fire!" and we hurry after them to see the cause of all this excitement.

A small dwelling has been ignited and smoke and flames are visible through the doorway. Buckets are hastily brought and a chain of men is formed to pass the water from a shallow ditch that runs through the street. But all at once a group of citizens hasten up with a curious contraption (Figure 10) which they place in the water. From it there runs a tube made of hollow reeds. Four men grasp the two handles of the apparatus and in a few moments a stream of water is pouring from the end of the tube to the great delight of the multitude.

“And who is the inventor of this useful machine?” we ask one of the watchers.

“Who, indeed?” he replies scornfully at our ignorance, “who but Hero the engineer could fashion such a thing?”

11. *The Mathematical Attainments of Hero.*

And so we return finally to the Museum and recount our experiences of the afternoon to those who dine with us. We are informed by some of his friends that we have only partially explored the abilities of Hero. For it seems that Hero is also a mathematician of real promise. He is editing the works of Euclid, and to the theorems of that master he has made some essential additions of his own. His practical mind has seen the need for simple rules of mensuration, and these he has been devising. The most important one, we understand, is that which gives the area of a triangle in terms of the lengths of its three sides.

Since this formula, which is known to all students of trigonometry, involves the extraction of a square-root, Hero has also devised what is probably the simplest of all the known methods to accomplish this calculation. Thus if A is the number whose square-root is desired, select any number which your fancy might dictate as a possible approximation to it. Then divide A by this approximate value and take the average of the original number and the quotient. Starting with this as a new estimate of the square-root, repeat the process. By continuing thus one can reach in a few steps a satisfactory estimate of the desired quantity. To this very day this simple process is known as *the method of Hero*.

We understand also that Hero is a skillful surveyor, and has invented for his work a very excellent dioptra, which serves for him the same purpose that the theodolite does for us. With it he is able to locate the direction which tunnels should take, so that the workers beginning simultaneously on both sides of a mountain will meet in the middle. This and many other practical problems he appears to have mastered completely.

And so we see again that those ancient people who dwelt within the walls of the golden city were much like men of later days. Among them lived great genius, whose imagination projected itself far out

beyond the ability of the multitude to follow. We can but idly speculate what the history of the world might finally have been had Hero and his predecessors been able to secure the patronage which their efforts so justly merited.

CHAPTER 9

COUNTING THE STARS

1. *The Astronomers*

ARATUS, THE MACEDONIAN POET in the days of Antigonus, begins his poem *Phaenomena* with an invocation to Zeus:

“From Zeus let us begin; him do we mortals never leave unnamed; full of Zeus are all the streets and all the market-places of men; full is the sea and the heavens thereof; always we all have need of Zeus. For we are also his offspring; and he in his kindness unto men giveth favorable signs and wakeneth the people to work, reminding them of livelihood. He tells what time the soil is best for the labor of the ox and for the mattock, and what time the seasons are favorable both for the planting of trees and for casting all manner of seeds. For he it was who set the signs in heaven, and marked out the constellations, and for the year devised what stars chiefly should give to men right signs of the seasons, to the end, that all things might grow unfailingly. Wherefore men worship him both first and last. Hail, O Father, mighty marvel, mighty blessing unto men! Hail to thee and to the Elder Race! Hail, ye Muses, right kindly, every one! But for me, too, in answer to my prayer direct all my lay, even as is meet, to tell the stars.”

The story of the stars is very ancient. Remote though the celestial bodies are from the surface of the earth on which we dwell, they have exerted an immense influence upon the lives of all of us. Not, as the astrologers believe, by casting spells upon our destinies, or by direct beneficences or injuries, determined according to the day of our nativity, but by exciting our imaginations and elevating our minds. True science began with the study of the stars, and through the long history of progress in discovering the secrets of nature, the stars have been our guide. Without them, we may ask, would there have been a Galileo or a Newton? and without these demi-gods would there have been a Faraday or a Maxwell? and without the works of these in turn would the minds of men everywhere have become conscious

of the vast powers of the scientific method for both good and evil? Correct, indeed, was Aratus in invoking the name of Zeus as the prelude to his story of the stars.

The history of Alexandria cannot fail to take account of the important discoveries which were made in astronomy by the Greeks, both by those who dwelt and worked in the golden city itself, and by those others who were associated with these studies. The roll of the great names in this catalogue of ancient scholars who busied themselves with the stars includes Aristarchus, Eratosthenes, Hipparchus, Posidonius, and Claudius Ptolemy. And of these, three spent most of their lives in Alexandria, while the other two, Aristarchus and Posidonius, probably were visitors at the Museum.

The first in point of time was Aristarchus, a native of Samos, who flourished about 280 B. C., and hence, although a contemporary of both Eratosthenes and Archimedes, was somewhat older than either of them. Little enough we know about his life, but it appears that he was a pupil of Strato of Lampsacus, a student of natural philosophy, who became the head of the Peripatetic school in Athens in 288 or 287 B. C. Since Aristarchus is known to have made an observation of the summer solstice in 281 B. C., and since his work is referred to by Archimedes, whom he thus preceded, it has been conjectured that he lived about 310-230 B. C.

2. *The Repudiation of Aristarchus.*

We have already mentioned, in our account of the dinner with Archimedes, the essential contributions of Aristarchus to the theory of astronomy. The most important of these discoveries was his enunciation of the proposition that the earth moves round the sun. Although we have none of the writings of Aristarchus which bear upon this point, the commentators upon his work leave not the slightest doubt that he had a genuine understanding of the problem.

But what is the most interesting to us in this history, perhaps, is the fact that the reaction of his contemporaries to the theory of Aristarchus was identical with that of those who first comprehended the same radical proposition advanced eighteen centuries later by Copernicus (1473-1543). For we find in Plutarch the following statement:¹

¹ *On the Face Appearing in the Orb of the Moon*, 6.

"Only do not, my good fellow, enter an action against me for impiety in the style of Cleanthes, who thought it was the duty of the Greeks to indict Aristarchus of Samon on the charge of impiety for putting in motion the Hearth of the Universe, this being the effect of his attempt to save the phenomena by supposing the heaven to remain at rest and the earth to revolve in an oblique circle, while it rotates, at the same time, about its own axis."

Here, then, was the same menacing prejudice which overwhelmed Copernicus and from which Galileo escaped by the narrowest of margins during the early years of the seventeenth century. Some have believed that the black opposition to the heliocentric theory was a consequence of a conflict with Christian authority and was thus a phenomenon to be associated strictly with the history of the church.

But the amazing fact appears to be that it was the subordination of the position of the earth to the other bodies in the firmament, rather than conflict with sacred records, that roused the deep hostility of men. For no longer was man the center of the universe, nor could he again believe that his puny affairs were more significant to the gods than those of other planets. Deny him his position of supremacy in the universe and you have denied him his divinity.

It is perhaps interesting for the record to say a word about Cleanthes, who brought the charge of impiety against Aristarchus because of his radical theory. Cleanthes, who came from the town of Assos in the Troad, was at first a professional boxer. This employment, however, appears not to have proved lucrative for he finally came to Athens with only four drachmas in his possession to study philosophy under Zeno, the Stoic. In order to maintain himself he worked nights drawing water for the gardens, but during the day "he used to exercise himself in philosophical discussions." According to Diogenes Laertius, his biographer, Cleanthes was very industrious, "but he was not well endowed by nature, and was very slow in his intellect. On which account Timon says of him:

'What stately ram thus measures o'er the ground,
And master of the flock surveys them round?
What citizen of Assos, dull and cold,
Fond of long words, a mouth-piece, but not bold.'

And when he was ridiculed by his fellow pupils, he used to bear it

patiently. He did not even object to the name when he was called an ass; but only said that he was the only animal able to bear the burdens which Zeno put upon him."

Although the indictment of Aristarchus came from a man condemned by his associates as the possessor of feeble wisdom, the rejection of the heliocentric theory on the part of Archimedes and his successors was for a totally different and a very cogent reason. This was the observation that the stars themselves showed no apparent motion, which would have been the case were the earth really moving around the sun. As we now know, the stars are so immensely far away that only the most refined instruments of modern astronomy can detect this infinitesimal parallax. In fact, it was not until 1838 that F. W. Bessel actually measured this displacement for 61 Cygni, the first star for which a parallax was found. It is significant to note that Proxima Centauri, the nearest star excepting our own sun, is actually more than four light-years from the earth.

It seems very curious to us now, with our better understanding of the dynamics of the universe, that the introduction of the heliocentric theory of the solar system should have been so stubbornly resisted. But we must remember that the vision of these early astronomers was greatly restricted. They lived at a time when the knowledge of the world was limited to the comparatively small area of the Mediterranean region. No extensive explorations had been undertaken; and the vast size of the western ocean was only surmised. It is to their everlasting glory that they were able to go as far as they actually did in the right direction.

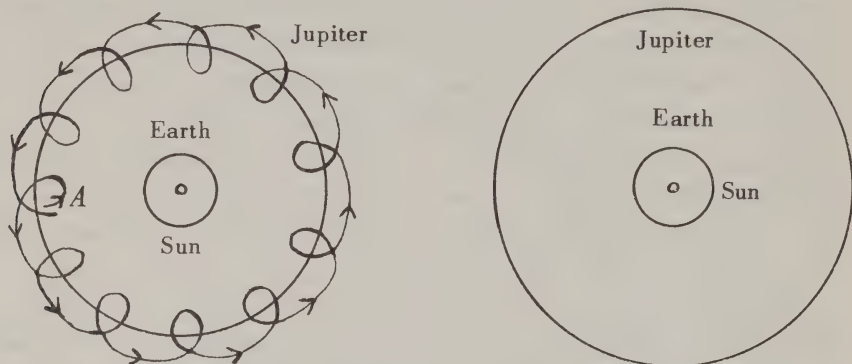
But faced by the stubborn fact that the stars showed no measurable displacement during the course of a year, all the astronomers except Aristarchus concluded that the earth remained at rest. No one raised the question as to the incredible velocities which the celestial bodies must maintain in order to complete their daily journey around the earth. It seemed easier to disbelieve the immense distances of the stars than to disbelieve such unthinkable velocities.

3. The Theory of Epicycles.

Another curious aspect of the struggle between the theories is found in the reluctance of the astronomers to replace a very difficult

pattern of planetary motion by a simple one. For if the earth is assumed to be fixed, then the actual path of the planets becomes a complicated one to describe, whereas, on the assumption of an immovable sun, these paths reduce very nearly to circular orbits. This contrast is easily seen in the accompanying figure where the scheme of Aristarchus is compared with that of his successors.

In the geocentric theory, one observes that the orbit of a planet such as Jupiter consists of a series of loops. This complicated path,



Comparison between the representations of the orbit of a planet as viewed from the heliocentric theory of Aristarchus and from the geocentric theory of his successors.

when contrasted with the circular orbit of the heliocentric theory, is generated by the fact that each planet, as viewed from a fixed earth, appears to revolve in a small loop, called by the ancient astronomers an *epicycle*, which in turn revolves around the earth in a large circle called a *deferent*. Since Jupiter, regarded from the point of view of the heliocentric theory, revolves around the sun in approximately twelve years, we observe that there are twelve loops along the deferent circle. That the last loop does not exactly join with the first at the point *A* of the figure is occasioned by the fact that the time of revolution of Jupiter around the sun is not exactly twelve years, but a fraction less.

The only work of Aristarchus that has been preserved for us is his treatise *On the Magnitudes and Distances of the Sun and Moon*. The content and methods of this remarkable monograph we have already

heard discussed by Archimedes in his dinner with King Ptolemy Philadelphus.

The next advance in astronomy was made by Eratosthenes, who, as we have related in an earlier chapter, succeeded in making a good estimate of the actual size of the earth, and in devising a scheme for the description of the natural objects upon its surface. The effect which the computation of Eratosthenes had upon the imaginations of his contemporaries is illustrated by an amusing story told by Pliny. It appears that a geometer by the name of Dionysodorus, a native of Melos, died at a ripe old age. In the course of his funeral rites his relatives discovered in the tomb an epistle in which the old geometer stated that he had descended from his grave "to the lowest part of the earth, and that it was a distance of 42,000 stadia." Since this is one-sixth of the value of the circumference of the earth as estimated by Eratosthenes, it will thus appear that the deceased had descended to a point very close to the center of the globe, and this interpretation was placed upon it by his friends.

4. *Hipparchus, the Father of Astronomy.*

After the scientific labors of the golden age of the Museum had ceased, somewhere around the close of the reign of Ptolemy Euergetes toward the end of the second century B. C., there was a period of comparative sterility in the arts of the mind. But during the rule of the benevolent Ptolemy Philometor there came a short renaissance, which produced at least one illustrious name. This was Hipparchus, who in the opinion of many is the greatest astronomer of antiquity.

That the period of Hipparchus was, indeed, one of renewed activity in the Museum is attested by the fact that several mathematicians flourished about this time. Among these we find, for example, the name of Diocles, who invented the clever curve known as the *cisoid*, the ivy-like figure by means of which he could solve the ancient problem of the duplication of the cube. We also encounter the name of Nicomedes, who invented the *conchoid*, the curve like a shell which not only duplicates the cube, but will also trisect an angle. A kind of anchor-ring, obtained by rotating a circle about one of its chords, was the object of the study of another mathematician by the name of Perseus. Zenodorus, who probably lived later than Perseus,

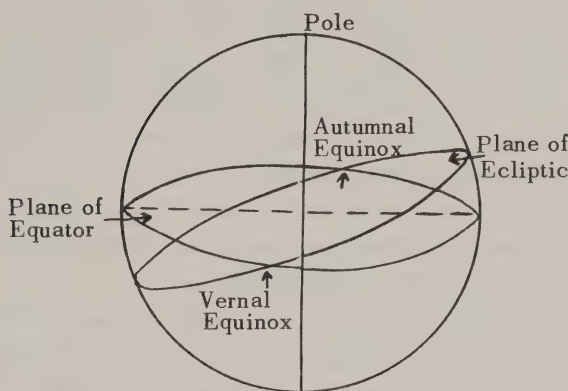
wrote a treatise on isoperimetrical figures; and Hypsicles was credited, although probably incorrectly, with the authorship of the fourteenth and fifteenth books of Euclid's *Elements*. Since the works of these men have for the most part disappeared, we now possess no way of judging their intrinsic power; but from the evidence that has come down to us, we can have little doubt that scholarship flourished in the Museum during this period. The achievement of Hipparchus thus is not an isolated phenomenon, but emerges as the work of a genius, who was encouraged and aided by a strong group of contemporary scientists.

Unfortunately our knowledge about Hipparchus is very scanty and only one work survives, a *Commentary on the Phaenomena of Eudoxus and Aratus*, which was written during his early years before he had made his great discoveries. Apparently Hipparchus was born at Nicaea in Bithynia, and probably made observations on the island of Rhodes from 161 B. C., but certainly from 146 B. C. to 134 B. C. Since he records an observation of the vernal equinox made at Alexandria on March 24, 146 B. C., it may be inferred that he lived for a time in the golden city and thus belongs to the history of the Museum. It is perhaps significant to note that this date lies within the reign of Ptolemy Philometor, whose death the following year precipitated the evils that attended the succession of the malevolent Physkon.

The greatest discovery of Hipparchus was his observation of the precession of the equinoxes, that is to say, the motion of the point in the sky where the plane of the ecliptic in which the earth moves around the sun intersects the plane of the equator. The situation is shown in the accompanying figure. Since this motion is very small, amounting to less than one minute of arc per year (50.3757 seconds) and thus requiring some 25,800 years for the equinoxes to make a complete circuit of the sky, it is amazing that it should have been detected by the acute insight of Hipparchus. But he had noticed that Timocharis, the astronomer with whom we had dinner when Archimedes visited Alexandria, had located the bright star Spica six degrees from the autumnal equinox somewhere between 295 B. C. and 283 B. C., whereas his own observations showed that the star was eight degrees from this point. Hipparchus thus correctly inferred that there had been an annual movement of the equinox, which he finally esti-

timated to be somewhere around 45 seconds per year. It was thus the careful measurements of Timocharis, made more than a century and a half earlier, that led Hipparchus to one of the finest discoveries of ancient astronomy.

Another great achievement of Hipparchus was his computation of the first table of the lengths of the chords of a circle corresponding to the angles which they subtend at the center. Those who have studied the theory of trigonometry may have wondered who was the first genius to construct the useful table so necessary for the solution of the



Hipparchus Discovers the Precession of the Equinoxes.

problems in this subject. Although one cannot say with absolute certainty that it was Hipparchus who first computed such a table, the evidence indicates that he was in possession of a set of values of chords similar to that found in the work of Claudius Ptolemy three centuries later. The table of Ptolemy, which we shall assume was either similar to, or identical with, that of Hipparchus, is a model of excellence. It gives the values of the chords of a circle with a diameter of 120 units for every half degree of arc and is thus equivalent to a modern table of sines computed at intervals of 15 minutes. The computations are accurate to six decimal places and the table contains a set of differences by means of which interpolations can be readily effected. Those who are experts in the field of mathematics

have always marveled at the ingenious set of theorems by means of which Ptolemy, or Hipparchus, was able to attain such great accuracy in his estimate of the lengths of the chords. Nothing comparable to this is found in mathematics until modern times.

One of the most important works of Hipparchus was connected with the problem of determining the length of the year, a matter of fundamental importance to the calendar as we shall show later. By means of careful observations Hipparchus discovered that the time between one vernal equinox and the next, a period of time which we call the tropical year, was something less than $365\frac{1}{4}$ days. This defect he estimated to be approximately one three-hundredth of a day, which was a little less than half the true value. But when we realize the crudity of the instruments with which Hipparchus had to work and note that the error made by him was only about six minutes per year, we marvel once more at the powers of this ancient astronomer. Perhaps the most amazing thing of all, however, was the fact that Hipparchus determined the mean lunar month to within one second of the present accepted value of 29.530596 days.

In our dinner with Archimedes we heard discussed the estimates made by Aristarchus about the distances from the earth to the sun and the moon and about their respective sizes. These estimates of Aristarchus were improved by Hipparchus who found, in terms of the mean diameter of the earth, that the diameter of the moon was 0.33, as compared with its true value of 0.27, that its distance from the earth was 33.67, compared with 30.2 in reality, that the sun's distance from the earth was 1,245 and its diameter 12.33, compared with 11,726 and 108.9 respectively.

The importance of possessing a good catalogue of the stars was recognized by Hipparchus and he continued the work of the early astronomers of the Alexandrian Museum. In this heroic task he gave the positions of at least 850 stars, referring their positions to a co-ordinate system originating with the ecliptic. In this table Hipparchus also distinguished between the apparent sizes of the stars, thus laying the foundation for the modern system of stellar classification.

From all of this we see that the work of Hipparchus certainly makes it possible for us to confer upon him the title of the Father of Astronomy. Reflecting years later upon the glories of the achieve-

ments of Eudoxus, Hipparchus, and Archimedes, the emperor Marcus Aurelius characterized these heroes very happily as "men of acute natural talents, great minds, lovers of labor, versatile, confident, mockers even of the perishable and ephemeral life of man."

5. *Posidonius and the Theory of the Tides.*

The work of Hipparchus was followed by that of Posidonius, nicknamed the *Athlete*, a Stoic philosopher, who lived from about 130 B. C. to 50 B. C. Although all of his works have disappeared, Posidonius unquestionably had a mind of unusual acuteness and breadth to judge from the many references to him made by his successors. His investigations covered a number of subjects ranging from a commentary upon the obscure *Timaeus* of Plato to measurements of the tides. Most of our information about Posidonius is derived from the writings of his pupil Geminus, but mainly from comments and quotations given by Strabo in his *Geography*. Strabo in his admiration for the work of this ancient scholar speaks of him as "Posidonius, the Stoic, the most learned of all philosophers of my time."

Although Posidonius was a native of Apameia in Syria, he settled as a teacher in Rhodes where most of his scientific observations were made. During his early years he traveled extensively through the Mediterranean countries making observations of the tides at Gades (Cadiz) in Spain. There can be little doubt that during these wanderings he spent some time in the golden city, although there seems to be no direct evidence that he made any extensive sojourn there. Posidonius became a famous teacher and some of the prominent men of Rome were at one time or another members of his school. Thus Cicero studied under him around 78-77 B. C. and speaks of him with admiration. Posidonius visited Rome at least once on an embassy in 86 B.C., but apparently did not settle there for any length of time.

Probably the greatest contribution made by Posidonius to the science of astronomy was his observation of the connection between the motion of the moon and the movement of the tides. Although this relationship had been noted earlier by Seleucus, the Chaldean or Babylonian (about 150 B. C.), who had also defended the heliocentric theory of Aristarchus, Posidonius made a number of observations and gave a substantially accurate and detailed account of this significant

phenomenon. A portion of the account, as related by Strabo, is worth quoting to show how far the matter of observation had progressed. Thus we find:

“... Posidonius says that the movement of the ocean is subject to periods like those of the heavenly bodies, since, behaving in accord with the moon, the movement exhibits first the diurnal, secondly the monthly, and thirdly the yearly period; for when the moon rises above the horizon to the extent of a zodiacal sign [that is to say, 30 degrees], the sea begins to swell, and perceptibly invades the land until the moon is in the meridian; but when the heavenly body has begun to decline, the sea retreats again, little by little, until the moon rises a zodiacal sign above her setting; then remains stationary until such time as the moon reaches the setting itself, and, still more than that, until such time as the moon, moving on below the earth, should be a sign distant from the horizon; but remains stationary again until the moon is elevated a sign above the earth and then it again invades the land. This, he continues, is the diurnal period.”

There is much more than this in the passage, but sufficient has been quoted to show that Posidonius had a clear perception of the relationship between the moon and the tides.

Let us turn the pages of science forward through eighteen centuries. Once more the great stream of speculation emerges from the caverns of time and man notices again the connection between the heavenly bodies and the ebb and flow of the sea. Perhaps no more astonishing matter exists in the entire annals of science than the fact that the observations of Posidonius waited eighteen centuries for the explanation given by Sir Isaac Newton. Compare, for example, the following quotation from Newton's *Principia Mathematica*, published in 1687, with the statement just taken from Strabo:

“The force of the sun or moon in raising the sea is greatest in the approach of the luminary to the meridian of the place; but the force impressed upon the sea at that time continues a little while after the impression, and is afterwards increased by a new though less force still acting upon it. This makes the sea rise higher and higher, till, this new force becoming too weak to raise it any more, the sea rises to its greatest height. And this will come to pass, perhaps, in one or two hours, but more frequently near the shores in about three hours, or even more, where the sea is shallow.”

We might almost believe that we were reading a continuation of the observations of Posidonius. Between the two, however, stands the enunciation of the law of universal gravitation. But when once the mind has grasped thoroughly the significance of the relationship between the moon and the terrestrial tide, the step across the chasm does not seem so very great. One can scarcely doubt that the powerful mind of Alexandrian genius could have taken the step had the golden era of the Museum been continued a little longer. It is to its everlasting glory, however, that it progressed to the very edge of the magnificent theory of Newton, and had caught a fleeting glimpse of what was undoubtedly one of the greatest achievements of the human mind. We cannot refrain from quoting a few lines from Edmund Halley's *Ode to Newton*, which might also have been written by an Alexandrian poet to the memory of Posidonius:

“Explained too are the forces of the deep,
How roaming Cynthia bestirs the tides,
Whereby the surf, deserting now the kelp
Along the shore, exposes shoals of sand
Suspected by the sailors, now in turn
Driving its billows high upon the beach.”

That Posidonius must have been an acute student of the stars and a careful observer of them is shown by the fact that he made the best estimates of any of the ancient astronomers about the size and distance of the sun. It is quite astonishing, considering the difficulty of the problem, to find that Posidonius gives as the distance to the sun the value of 6,545 earth-diameters, an estimate considerably better than half the true figure of 11,726. His computation of the diameter of the sun was also nearer the truth than that of his contemporaries, being $39\frac{1}{4}$ earth-diameters. Although this was also far from the true value of 108.9, it was more than three times greater than the estimate of Hipparchus.

6. *The Last Great Astronomer of Antiquity.*

The last great astronomer of antiquity was Claudius Ptolemy. Although few details of his life have been recorded, he is known to have lived in Alexandria about the middle of the second century of the Christian era and was a native either of Pelusium or of Ptolomais

Hermii, a Grecian city of the Thebaid in Upper Egypt. The first recorded observation of Ptolemy is known to have been made in 127 A. D. and the last in 151 A. D., which shows that he flourished during the reigns of the emperors Hadrian (117-138) and Antonius Pius (138-161). This is rather significant since we see that the astronomer was a contemporary of Galen, the physician, and Lucian, the writer, men of comparable distinction in their respective fields.

This was probably not entirely an accident since the middle of the second century was a period of comparative stability throughout the Roman empire, quite in contrast to the unstable and violent reigns of the later emperors. In Alexandria, in particular, there was a mild renaissance during the rule of Emperor Hadrian, who in 130 A. D. had become a patron of the Museum and had established some new professorships in philosophy. But the period, judged by its contribution to art and science, was quite insignificant when compared with the golden age of the early Ptolemies. The thoughts of people were directed toward the mysteries of the metaphysical world rather than toward the realities of science and the phenomena of nature. We have already shown how this tendency affected the achievements of Galen; it also exerted its influence upon Claudius Ptolemy, the astronomer, who, for all his wonderful achievements, probably went very little beyond the work of his master Hipparchus in the matter of actual discovery.

It is not known exactly where Ptolemy did his observational work, but we are told by Olympiodorus, a Neoplatonic philosopher of the time of Emperor Justin, that Ptolemy lived for forty years in "the Wings of Canopus." This was probably an elevated area near the temple of Serapis at Canopus, which, as we have seen earlier in our chronicle, was a town situated about fourteen miles east of Alexandria upon the banks of the Nile. Some writers have made the claim that the astronomer belonged to the royal race of the Ptolemies and he is sometimes referred to as the king of Alexandria, but there is no evidence to support these beliefs. No reference is made to his work by Athenaeus, who was a contemporary, and we are left with only a few meager details about the life of this great scholar.

The astronomical work of Ptolemy is given in a monumental volume which bears the title of *The Great Composition*, but which is known

universally by its Arabic name of the *Almagest*. This is presumably a hybrid word formed from the Arabic article, *Al*, and the Greek word for "greatest." The *Almagest* remained for fourteen centuries the supreme authority in astronomy, and its influence over the thoughts of men declined only with the final overthrow of the geocentric theory by the successors of Copernicus in the sixteenth century.

It is probable that a considerable part of the *Almagest* was derived from the work of Hipparchus, of whom Ptolemy always speaks in the highest terms. It is not to detract from the reputation of Ptolemy that this statement is made, for only the greatest praise can be given to the scientific acumen of the author of the *Almagest*, but merely to indicate at this late date in history the impossibility of untangling the contributions made by each man to the monumental achievement of ancient astronomy.

The *Almagest* itself consists of thirteen books, the first two introductory and mathematical, the third devoted to the length of the year and the theory of the sun, the fourth to the length of the month and the movement of the moon, the fifth to a description of Ptolemy's chief astronomical instrument, the astrolabe, the sixth to eclipses, the seventh and eighth to a catalogue of stars, and the last five to the theory of the motion of the planets.

The greatest original contributions of Ptolemy to the subject of astronomy are found, first, in his computation of the orbits of the planets, in which he adopted the epicyclic theory of Hipparchus, and, second, in the deepened knowledge that he possessed of what are called *the inequalities of the motion of the moon*. Since his catalogue of stars appears to be identical with that of Hipparchus, except for the introduction of the correction necessitated by the precession of the equinoxes at the rate computed by Hipparchus, one may assume that Ptolemy added nothing original to the work of his distinguished predecessor in this regard.

7. *The Story of the Calendar.*

The struggle of the ancient astronomers with the difficulties of the calendar forms a story of absorbing interest to those who have any speculative regard for the mysteries of time. Inexorably the flow of the days and the seasons moves on, and the movement of this

stream of time is brought into accord with our civil lives by means of a calendar from which we may learn the dates of plantings, seasonal festivals and the like. But the ancient proverb which instructs us that "March winds and April showers bring forth May flowers" has not always been correct. For at periods the real seasons have fallen behind the civil seasons, as, for example, in the time of Julius Caesar when our jingle should have read "June winds and July showers bring forth August flowers" in order to be understood.

The difficulty in the problem rests upon two points. First, the mean solar year, usually called the tropical year, by which we mean the average lapse of time between one vernal equinox and the next, is not an integral number of days. Second, the mean lunar month, by which is meant the average number of days between one new moon and the next, is not an integral part of the mean solar year. Ancient astronomers experienced considerable difficulty in determining with sufficient accuracy these important constants; and although a small error in their determination would have an inconsequential effect in any single year the accumulative effect of a small variation in an annual figure magnifies itself a hundred-fold in a century.

Modern observations show that the tropical solar year consists of 365.2422 days and the lunar month of 29.53059 days. Hence, if a calendar were adopted, as in the case of the Mohammedan chronology, of twelve lunar months for one year, that is to say, 354 days, the seasons would move around the year at the rate of about 11 days annually and would complete the cycle in a little more than 33 years. Such a calendar obviously would lead to endless confusion, as it has in the case of the determination of dates given by the Mohammedan historians. But it is also clear that the same confusion would result, although more slowly, if a civil year of $365\frac{1}{4}$ days were adopted. In fact the error amounts to only a little more than three days in four centuries, which is not noticeable in a single century, but becomes quite significant in twenty centuries.

Although the civil calendar for most of the western world finally was referred to the tropical year, the relationship between the lunar year of twelve months and the tropical year was the object of considerable study. One of the most interesting achievements in this regard made by the ancient astronomers was the discovery of the so-

called *Metonic cycle*. This came from the observation of Meton, a Greek astronomer who lived about 460 B. C., that 19 solar years were almost exactly equivalent to 235 lunar months, the error being less than a single day. That is to say, after a lapse of 19 years the date of the new moons would return to the same days of the month as they had at the beginning of the cycle.

As one may well believe, the history of the calendar belongs also to the history of the golden city, for it was the Alexandrian astronomer Sosigenes, who provided Julius Caesar with the information by means of which he made his famous reformation in our methods of recording dates. Since, in the day of the Roman conqueror, the vernal equinox had slipped from the 25th of March, its original date, to the end of June, which thus made January an autumn month, Caesar was anxious to remove the state of confusion that then prevailed in the calendar.

It is probable that Caesar met Sosigenes, while he was tarrying in the court of the attractive princess Cleopatra; for it was immediately after his return to Rome from Alexandria in the year 46 B. C. that he made his famous reformation of the calendar. Pliny frequently refers to a work by Caesar on the stars and this was doubtless composed under the tutelage of Sosigenes. The Julian calendar restored the vernal equinox to the 25th of March by intercalating three months, a total of 90 days, in the year 46 B. C., which is known as "the last year of confusion." In order to take account of the annual excess of a quarter-day over 365, a leap year was provided every fourth year in which an extra day was intercalated. But, as we have previously remarked, the difference between the Julian year of 365.25 days and the solar year of 365.2422 days amounts to an error of something more than three days in four centuries. Hence, at the time of the Nicean council in 325 A. D., when the date of Easter was established, the error was nearly three days, and by 1582, when Pope Gregory XIII again reformed the calendar, the equinox had retrograded to March 11. Thus, in order to restore the vernal equinox to the 21st of March, ten days were dropped from that year, and the scheme adopted of omitting the intercalations of leap year in every centenary year excepting those which are multiples of 400. Thus 1700, 1800, 1900 were ordinary years, but 2000 will be a leap year. A slight error

still remains in the Gregorian scheme, but since it will not be of significant size for another twenty centuries, the race need worry very little about the matter during the next few generations.

8. *The Significance of the Stars.*

And thus we see, from this brief survey, that the scholars of Alexandria, aided by their contemporaries, laid the foundation for the impressive structure of modern astronomy. Peering into the vast heavens, measuring with their imperfect instruments, speculating upon the wonders of the firmament, these noble spirits saw more clearly than other men that science could be built only by painstaking observation of the phenomena of the universe about them and by a careful interpretation of the relationships thus observed.

But many other people, looking into the same sky, saw in the motion of the planets, and in the terrifying beauty of the eclipses, and in the appearance of comets, something not discovered by the astronomers. They thought that they observed between these celestial objects and their own lives a mystical bond which foretold their individual destinies. Or as Emerson has put the matter in his essay on *Beauty*: "Astrology interested us, for it tied man to the system. Instead of an isolated beggar, the farthest star felt him, and he felt the star."

The belief in portents was wide-spread throughout the ancient world. In the writings of such men as Plutarch and Suetonius we find the constant intrusion of natural phenomena into the destinies of their heroes. And in this extensive superstition we behold again the momentous struggle between the careful methods of science and the blind credulity of the majority of mankind who preferred to believe in a doctrine founded upon occasional coincidence, rather than in the less spectacular measurements of the scholars. Alas, this same warfare will probably continue to the end of time despite the ever-growing knowledge of the astronomers.

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